MACHINERY

Design—Construction—Operation

Volume 42 OCTOBER, 1935 Number 2

PRINCIPAL ARTICLES IN THIS NUMBER

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The synthetic plastic materials are becoming ever more important. Research and experiments are constantly being carried on with a view to perfecting those already known and to developing others still more useful and attractive. In the synthetic plastic group of materials, Plaskon, a product of recent development, has created an important place for itself. The leading article in November MACHINERY will deal with the characteristics and properties, methods of molding, and manifold applications of Plaskon.

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PUBLISHED MONTHLY BY
THE INDUSTRIAL PRESS
148 Lafayette Street New York
ROBERT B. LUCHARS.....*President*
EDGAR A. BECKER..*Vice-pres. and Treasurer*
ERIK OBERG .....*Editor*
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LONDON: 52-54 High Holborn
PARIS: 15 Rue Bleue

YEARLY SUBSCRIPTION: United States and Canada, $3 (two years, $5); foreign countries, $6. Single copies, 35 cents.
Changes in address must be received by the fifteenth of the month to be effective for the forthcoming issue.
Send old as well as new address.

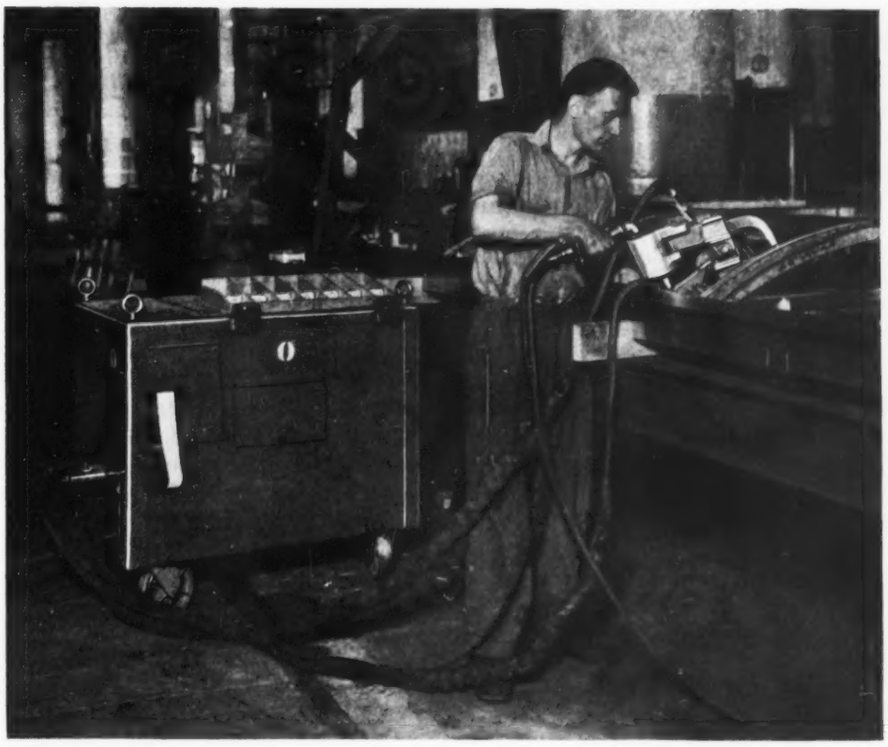
Entered as second-class mail matter, September, 1894, at the Post Office, New York, N. Y., under the Act of March 3, 1879.
Printed in the United States of America.

MACHINERY

Volume 42 NEW YORK, OCTOBER, 1935 Number 2

What is Shot-Welding?

By CHARLES O. HERB



A Recent Development that is Being Used to Fabricate a Million Pounds of Stainless Steel Yearly in One Plant Alone

WHEN streamline trains of stainless steel first captured the popular imagination by their speed and economical performance, articles appearing in the technical and news press emphasized the fact that the trains had been constructed by the Edward G. Budd Mfg. Co., Philadelphia, Pa., through the application of a new welding method known as "Shot-weld." What the Shot-weld method was, what it did, and why it was developed were, however, not explained sufficiently to answer the questions of engineers interested in its possibilities.

To begin with, the process can be applied in many other ways than in the building of modern railway trains. It has been used also in constructing from stainless steel the entire framework of airplanes, the bodies of automobile trucks, and many parts used on board ship. For example, the storm windows of the magnificent new French liner, the *Normandie*, are made of stainless steel sheets and strips, welded together by the Shot-weld method.

At the present time, over 500 workmen are engaged daily in the Budd plant in fabricating parts

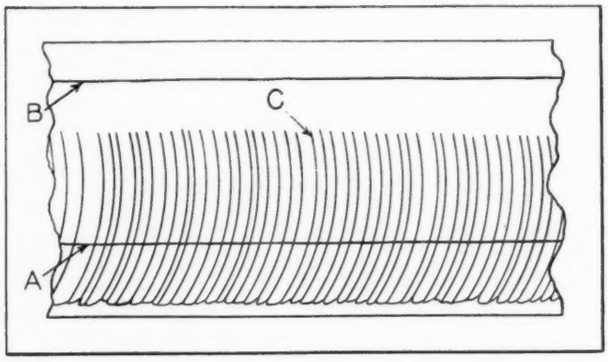


Fig. 1. Diagram of the Tape on which a Record is Made of Each Shot-weld Operation to Indicate How Closely it Meets Requirements

from 18-8 stainless steel by the Shot-weld process. Approximately a million pounds of stainless steel are being fabricated annually by this method in that one plant.

The Shot-Weld Process was Developed Especially for Stainless Steel Fabrication

When consideration was first given by the concern to the fabrication of airplanes and trains from stainless steel, it was determined that the high strength of the material could be fully utilized only by welding it into the required beams, trusses, and other sections. Because of the classes of service for which these stainless steel structures would be applied, it was decided that a method of welding would have to be developed that would insure uniform welds of adequate strength, without sacrificing the inherent characteristics of stainless steel. The experience of the concern in manufacturing automobile bodies indicated that ordinary spot-welding would not be satisfactory for stainless steel fabrication, tests having shown that there is several hundred per cent variation in the number of heat units delivered in successive spot-welding operations when the work is controlled manually.

One of the most important requirements in welding stainless steel is that the metal must not be heated beyond a certain point. Stainless steel of the 18-8 class is not inherently stainless, its maximum resistance to corrosion being obtained only with a heat-treatment that necessitates quenching from a temperature of approximately 2000 degrees F. After this heat-treatment, stainless steel is non-magnetic, very ductile, non-corrosive, and capable of being cold-worked. However, subsequent heating for any considerable time to between 800 and 1500 degrees F. will cause 18-8 stainless steel to lose some of its non-corrosive qualities and also to become brittle. In welding stainless steel, therefore, it is essential to avoid heating beyond about 600 degrees F.

Stainless steel is particularly well adapted to spot-welding, since it has an electrical resistance from eight to ten times that of ordinary steel, and its surfaces are clean and free from oxides. In addition, the austenitic nature of stainless steel results in soft tough welds instead of the air-hardening welds obtained with ordinary steels. Spot-welds made correctly on 18-8 stainless steel have a shear strength of 90,000 pounds per square inch—certainly a most remarkable figure.

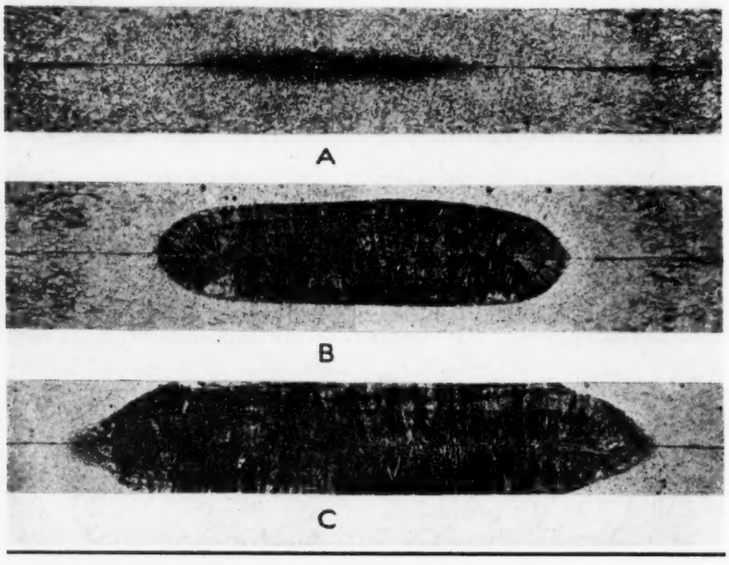


Fig. 2. Photomicrographs of Stainless Steel Sheets Shot-welded Together. The Magnification is 40 Diameters. Example A is Insufficiently Fused; Example B Indicates Correct Welding; and Example C Shows a Burnt Weld which Would Soon Corrode at the Outside Surfaces of the Sheets

The Shot-Weld Method is Closely Controlled Spot-Welding

With these various considerations in mind, it was decided to improve spot-welding procedure so that welds having the required strength could be uniformly produced by means of automatic equipment that would instantly indicate any deviation from established welding conditions. Such equipment would have to give accurate control of the welding time, the character of the electrical current, and the pressure exerted by the electrodes. The results now being obtained with the equipment finally developed by Colonel E. J. W. Ragsdale and his staff to meet these requirements are sufficiently different from ordinary spot-welds to justify the use of a new term for the process, and so the expression "Shot-weld" was coined. Shot-welding is essentially refined spot-welding.

With the equipment used in the Shot-weld method, the time of the actual welding is controlled to a fraction of a second by means of tube controls, or a mechanism driven by a synchronous motor. By this means, the duration of the welding period is controlled so closely that, even though the temperature at the point of fusion is more than 3000 degrees F., the temperature on the outside surfaces of the stainless steel with which the electrodes contact does not exceed 500 degrees F.; thus the characteristics of the stainless steel are retained. Stainless steel strips as thin as 0.002 inch have been welded without affecting the outer surfaces. The high heat that produces the weld extends only about one-half the distance from the point of fusion to the outside surfaces of the strips.

Each Welding Operation is Recorded on a Paper Tape

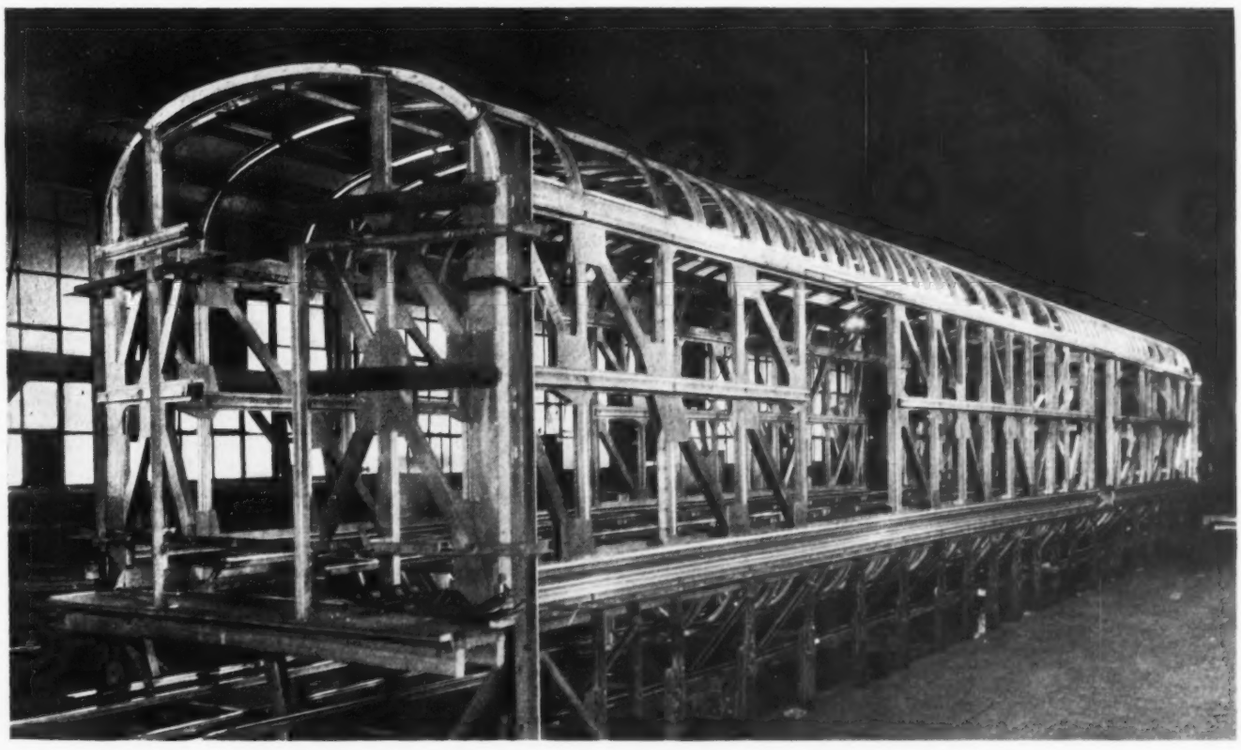
Another important feature of the Shot-weld method is that each operation is recorded on a paper tape by a scriber that passes across the tape during the entire length of the welding period. This record shows how closely each welding operation meets the predetermined requirements. In the heading illustration, which shows a typical welding operation, the tape may be seen at the side of the unit.

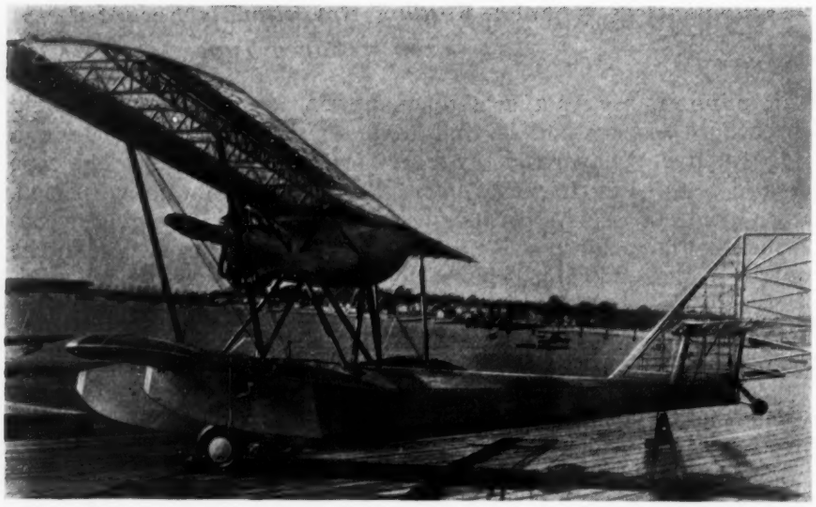
Fig. 1 shows diagrammatically a portion of a typical tape record. The scriber starts near the bottom of the tape; if it fails to pass beyond line *A*, the length of the welding period is insufficient to permit satisfactory fusion of the pieces being welded. The result would be a fusion such as is indicated by the photomicrograph *A*, Fig. 2.

On the other hand, if the line scribed by the recording unit passes beyond line *B*, the welding period will be too long, with the result that the fusion of the pieces being welded may extend to their outside surfaces, as shown at *C*, Fig. 2, giving a "burnt" weld. Satisfactory fusion, as indicated at *B*, Fig. 2, is obtained when the scribed lines *C*, Fig. 1, end somewhere between lines *A* and *B*.

If, in any welding operation, the scriber fails to reach line *A* of the tape or passes line *B*, a bell on

Fig. 3. The Stainless Steel Framework of One Car for a Modern Streamline Railway Train





The Shot-weld Process Provides the Exacting Welding Reliability Highly Essential in Airplanes, Streamline Trains and Automotive Equipment

the welder will ring, thus notifying the operator and his supervisor that the unit is not functioning properly. The bell cannot be stopped until the equipment has been reset by the welding inspector to operate according to the established requirements.

In addition to providing a permanent record of the conditions under which each welding operation is performed, the tape shows how many welds are made daily with each machine. In other words, the tape shows how many welds have been made and how well they are made. On complicated work, a good operator can average ten welds a minute throughout the day, while on simple work, consisting of straight seams, forty welds a minute can readily be made. In automatic set-ups, welds have been made at the rate of several hundred a minute.

The Shot-Weld Method is Speedy

To avoid intense heat on the outside surfaces of the stainless steel pieces being welded, it is, of course, necessary to do the actual welding at great speed. The length of the welding period varies from 1/120 to 1/3 of a second, depending upon the thickness of the pieces being welded. Welds having an aggregate thickness of 1/2 inch are common practice; and in a test, eleven plates, each 1/8 inch thick, were welded together in a single operation. After this test was performed, it was found that a solid ingot of molten metal extended through the eight sheets to within a short distance of the outer surface of the bottom and top plates. The ability to simultaneously weld sheets together in multiple presents considerable advantages.

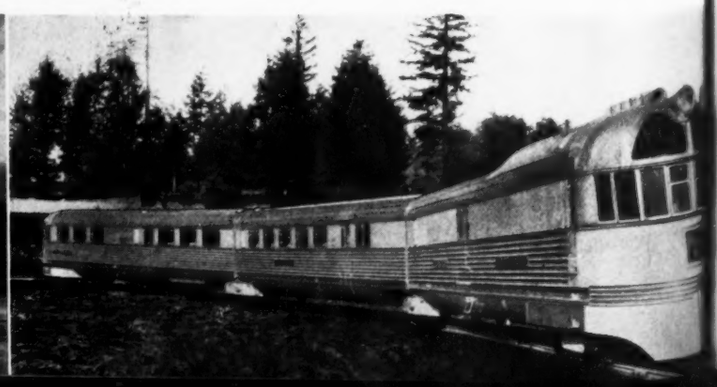
In building the Burlington *Zephyr*, the gages of stainless steel welded together varied in thickness from 0.012 to 0.050 inch. All together, 46,000 pounds of stainless steel were fabricated into this train. The large amount of welding performed in building such a train is indicated by Fig. 3, which shows the framework of one car.

The voltage of the electrical current used in welding depends upon the number and thickness of the sheets being joined. Current from 2 to 12 volts is employed, while the amperage ranges from 2000 to 40,000. The pressure exerted by the electrodes varies from 40 to 4000 pounds. In welding two sheets of stainless steel, say, 0.012 inch thick, the heat requirement is only about 0.035 British thermal units.

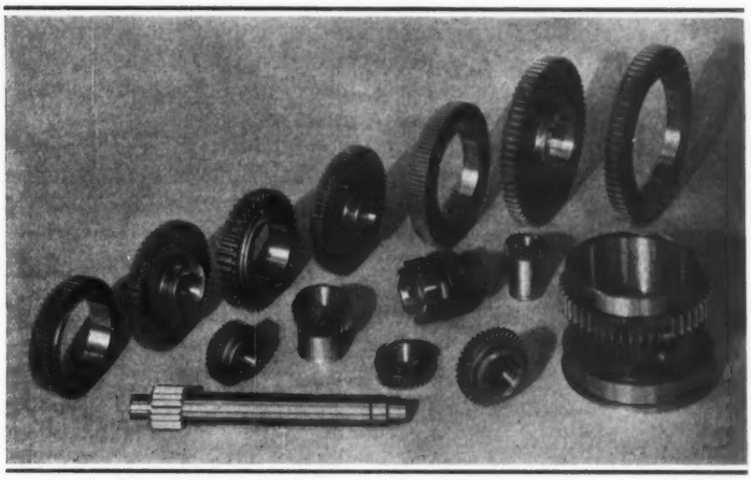
Many Types of Shot-Welding Machines Are in Use

In the Budd plant, approximately 100 machines using the Shot-weld method are being applied on a large variety of stainless steel work. Many of these machines are of the portable type shown in the heading illustration, but there are also stationary machines of various kinds, designed for semi-automatic and automatic operation. Some machines are constructed for the continuous welding of stainless steel strips by feeding them through rollers that serve as electrodes. Comparatively little scrap is obtained in fabricating stainless steel, as small pieces can invariably be used to advantage.

Various concerns licensed by the Edward G. Budd Mfg. Co. to employ the Shot-weld process include the U. S. Steel Corporation; Fleetwings, Inc., Bristol, Pa.; and six establishments in Europe.



Manufacturing Hardened and Ground Gears for Turret Lathes



Procedure Followed in Producing Accurate Gears with High Wearing Qualities for Machine Tools

By W. J. BURGER, Works Manager
The Warner & Swasey Co.,
Cleveland, Ohio

THE production of efficient gears has, perhaps, been the cause of more trouble and worry to the engineer and the production superintendent than any other single problem having to do with the design and manufacture of machines. The major problem in gear manufacture has to do with the fact that a gear, in order to possess proper wearing qualities, must be hardened by heat-treatment—and heat-treatment sufficient to harden properly inevitably causes distortion. Thus gears machined very accurately and then properly hardened often become too warped for efficient use.

On the other hand, gears machined to proper accuracy and heat-treated, but not hardened, do not possess sufficient wearing qualities. The latter method, nevertheless, was widely followed until a few years ago, and to some extent is still being used. It will not, however, produce gears capable of functioning under the severe conditions now demanded. The introduction of cemented tungsten-carbide cutting tools, the use of heavier cuts and higher spindle speeds, and the requirements of better finish and freedom from gear marks on the work have combined to make new standards of gear accuracy and performance necessary, and make it essential that gears possess the utmost in wearing qualities. The Warner & Swasey Co., therefore, came to the conclusion some time ago that it is necessary to harden the gears—obtaining final accuracy *after hardening* by a series of grinding operations.

The process is one of machining, heat-treating, and grinding—a much longer and more expensive process than the older methods, but one which, it is believed, is necessary to produce gears that will insure long life and quiet, efficient operation of machine tools.

For a line of turret lathes from 5/8 inch to 12 inches bar capacity, gears must be produced up to 28 inches in diameter — some ring gears, some disk gears with hub on one side, and others of varying descriptions, which must be hardened to possess proper wearing qualities and, at the same time, must be highly accurate.

Materials Used in Making Gears for Turret Lathes

There are a number of good materials to select from for making gears. They may be divided into two classes—carburizing and oil-hardening steels. In selecting a steel for turret lathe gears, we had two factors to consider. First, the steel had to be tough enough to stand clashing when sliding gears into mesh and, second, the steel had to be hard enough to withstand the wear on the teeth. Also, it was necessary to consider a steel that was carried in stock. S A E 3150 seemed to fill these requirements. Although S A E 3145 is more common, it was found that the higher carbon content of S A E 3150 would give the gear a higher Brinell hardness and produce better wearing surface of the teeth.

Gears above 7 inches in diameter are made of forgings, and those below 7 inches, of bar stock. Gears made from bars are not so strong as those made from forgings. In the present case, however, this is not a factor of any consequence, because in either event there is more than ample strength in the gear teeth. The vital factor is ample wearing surface of proper quality, and with large enough gear teeth to give ample wearing surface, there is nothing at stake as far as the strength of the steel is concerned.

All the bar steel is tested for Brinell hardness when received. Forgings are normalized, and each forging is also tested for Brinell hardness. Forgings, when properly normalized and with the proper analysis, have a Brinell hardness of from 196 to 207. This method of testing will detect any gears that might not comform with the specified analysis, due to carelessness in the forge shop, and they can be discarded before any machine work on the gear has been performed.

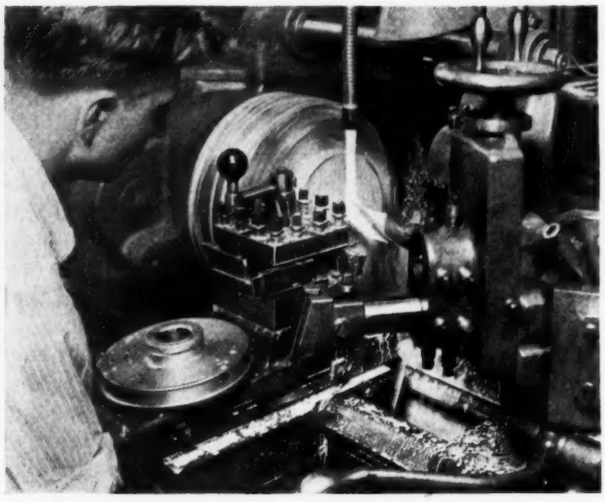
The Machining Operations

The turning operation on the gears is performed on turret lathes. It is simple, because the machining operations prior to hardening do not determine the final accuracy of the gear. Final accuracy is dependent upon the grinding operation after hardening. Therefore, the machining tolerances are liberal, and the only important dimension is the bore to fit the arbor for the gear-cutting operation. Most of the gears can be finish-turned complete in two chuckings on a turret lathe. In machining the smaller gears from bar stock, a number of gears can often be turned with one chucking of the bar by letting the bar project far enough from the chuck in the turret lathe. This method saves considerable time in rechucking the bar and setting tools.

Broaching and drilling operations, if necessary, are not done until after the gears are hobbed. This eliminates the necessity of removing any of the burrs in the hole that might be caused by these operations, in order that the gear will fit the arbors for the gear-cutting operation. A 20-degree pressure angle full depth form of tooth has been selected in preference to the 14 1/2-degree stub tooth. The 20-degree angle provides a better "roll," and a stronger tooth.

Since the teeth are ground later for final accuracy, the gear-cutting operation requires no special care as to accuracy. Only one roughing cut gives a satisfactory finish for grinding. We use

Fig. 1. Turning Forged Gear Blanks on a Heavy-duty Turret Lathe



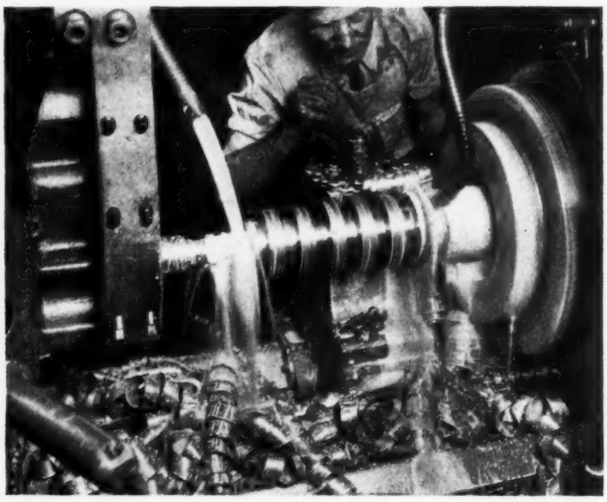


Fig. 2. Turning Small Gear Blanks from Bar Stock on a Turret Lathe

Fig. 3. Electric Furnaces for Heating Gears for Hardening prior to Grinding the Teeth

topping cutters, in order to have a surface true with the gear-cutting operation, for holding the gear while grinding. Special gear-cutters are used to allow 0.004 or 0.005 inch on the side of the teeth for grinding.

The heat-treating or hardening operation is a very important step in making a uniform and satisfactory gear. The terms "heat-treating" and "hardening" are often used in a misleading way. The term "heat-treated" can be applied to any heat-treating operation, even though it is simply a normalizing or annealing operation. When used in connection with gears, it usually denotes gears that are heat-treated prior to the machining operation and are soft enough to enable finish-machining to be done. The term "hardening" applies to a heat-treatment that leaves the gears in a condition too hard for subsequent machining. A hardened gear, of course, resists wear better under heavy loads, maintains its accuracy on the involute curve longer, and has a longer life.

The equipment found most suitable for hardening gears consists of two electric salt furnaces, automatically controlled; an oil quenching tank; a washing tank; and an electric drawing furnace. This equipment is in line, and is serviced with a crane. The operation consists of preheating the gear in the first salt bath. It is then transferred to the second salt bath, which has the proper hardening temperature. From there it passes to the oil quench. The gear is next washed and finally goes into the drawing furnace. The salt bath was selected for heating the gears because it insures uniform heating, and when the heated gear is transferred to the quenching bath, it has a coating of salt which prevents the air from oxidizing the surface. A simple wire brushing operation leaves the gears clean and free from scale after hardening. Each gear is now tested again for Brinell hardness.

The Grinding of the Gears Completes the Process

Up to this point, extreme care has been given to inspection of material and hardening, but final accuracy has not yet entered into the picture. After hardening, however, accuracy becomes foremost, and is obtained by three simple grinding operations.

The first grinding operation, done on a standard internal grinder, consists of grinding the hole and one face in the same chucking. These operations are combined to insure having the first face ground true with the hole and to prevent any side runout when mounting the gear. A slight eccentricity between the hole and the finished gear teeth is not serious, but any side runout is very objectionable. In this operation, the gear is chucked on top of the teeth. This method of chucking is much simpler than using pins in the gear teeth, and for that reason, topping cutters are used in cutting the teeth. Reasonable care must be taken in chucking the gear true to insure uniform grinding of stock in the gear teeth.

The second grinding operation is a very simple one, consisting of grinding the second face parallel with the first face, which has already been ground true with the hole. This operation is done on a surface grinder with a magnetic chuck.

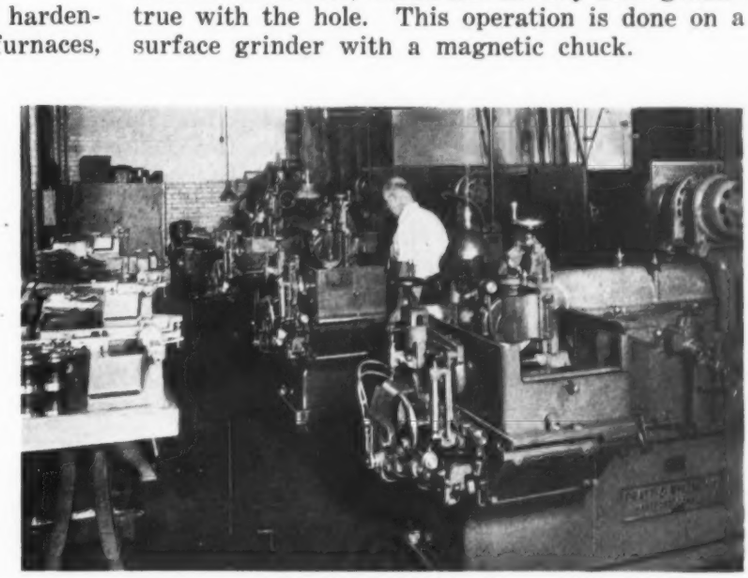


Fig. 4. Final Operation—Grinding the Teeth of the Gears after Hardening

Grinding the teeth is the final operation. This is done by an abrasive wheel mounted on a reciprocating slide. The wheel is dressed to the shape of a rack tooth, and grinds the sides of two teeth simultaneously. Care must be taken to mount the gear on the grinding arbor in such a way that the ground face runs absolutely true. Measuring the involute curve with an indicator will check the setup of the machine. As an extra refinement, the mat surface left by the grinding wheel may be removed by a lapping operation, but this has to do with appearance only; if it is omitted, the surface of the gear teeth will be burnished smoothly after a few hours' run.

The handling of the gears in the shop presents a problem in itself. If a finished gear is dropped or bumped, a nick may result which will cause trouble when the gears are assembled. To prevent this, a special truck-platform has been designed for transporting the gears around the plant, with racks so placed that the gears cannot slip or fall.

While this method of manufacture involves more pains and expense than older methods, it does have distinct advantages from an operating standpoint, chiefly for two reasons: (1) Machining operations do not have to be done with extreme accuracy; and (2) the grinding operations are comparatively simple, and can easily be handled by an average operator after a little experience.

In terms of final results, this method of manufacture assures the uniform transmission which only complete accuracy can give, quietness of operation, and maximum endurance, due to hard wearing surfaces.

Marked Improvement in British Industrial Conditions

Business conditions in Great Britain appear to be more favorable than at any time during the last fifteen years. Many branches of the machinery industries are actively engaged, and most machine tool plants have a capacity business. Some big foreign contracts, both for machine tools and for other engineering equipment, are materially aiding an active domestic market. The Metropolitan-Vickers Electrical Co. of Trafford Park, Manchester, for example, has obtained a $15,000,000 contract for the electrification of important sections of the Brazilian Railways.

Soviet contracts include an order received by Davy Brothers, Sheffield, for a complete forging and rolling plant for the production of railway wheels and tires. The machinery, designed for an output of 36,000 tons a year, includes a 3000-ton forging press, roughing and finishing mills, marking and rectifying presses, etc. Another Sheffield concern is engaged on a large order for circular wood-cutting saws and frame saws which will form part of the equipment of what will be the largest modern sawmill in Europe. A firm in Scotland is working on a Russian order for 4000 pairs of railway wheels and axles; this has kept the plant busy for several months.

In its thirty-third annual report covering the year 1934, the British Society of Motor Manufacturers and Traders points out that the United Kingdom has made the first and most rapid recovery from the depression of any country in the world. The production in the automotive industry of Great Britain for the year ending September, 1934, amounted to 257,000 passenger cars and 85,600 commercial vehicles. This is the largest production ever attained in Great Britain.

Two of the largest builders of textile machinery in Lancashire report increased activity and excellent financial results. Some of the textile machinery shops are working over-time. A considerable part of the machinery is for Lancashire mills that are being changed over from cotton to the manufacture of artificial silk.

The shipbuilding industry, while still far from normal, shows indications of revival in several yards.

Important extensions are being made to a number of engineering works. The Austin Motor Co., Ltd., for example, is making another extension that will add 150,000 square feet of floor space to the Birmingham works of the company. Another large factory, covering 120,000 square feet, is being erected by Fisher & Ludlow, Ltd., for the manufacture of pressed-metal parts. Employment conditions in Birmingham are now equal to those of prewar days.

The manufacture of oil-well equipment is being extended in Great Britain, a large plant having been opened in Stockport for the manufacture of such equipment.

Recently a large continuous rolling mill for the hot-rolling of steel strip in coil has been completed in Sheffield, incorporating the most up-to-date features of American and continental practice. The mill is capable of rolling up to 100 tons of strip per shift in sizes from 1 inch to 16 inches in width. The estimated average weekly output is 1000 tons.

The home-building activity in Great Britain continues. Close to 3,000,000 homes have been built in the last ten years, and evidences of home-building activity are seen in practically every city, town, and village throughout the country. Another indication of increasing business activity in Great Britain is the large number of telephones that have been installed during the past year, both for business purposes and home use.

The Machine Designer Must Follow the Trend of the Times

It is No Longer Sufficient that a Machine Perform Efficiently the Work for which it is Designed; it Must also Meet Present-Day Ideas of Appearance, Convenience of Operation, Accessibility, etc.

By BERNARD LESTER
Assistant Industrial Sales Manager
Westinghouse Electric & Mfg. Co.
East Pittsburgh, Pa.

THE outstanding progress that has been made in all fields of manufacturing has been due particularly to the skill of the designer of machinery, working in close coordination with the user of the machine. From the viewpoint of the machinery builder, invention and construction have outstripped distribution. The mounting cost of distribution of machinery, including selling, has in recent years been receiving greater scrutiny. More attention is now being paid to market requirements and distribution methods. This subject is of direct interest to the machine designer.

The chief objective of the machine designer is the development of a machine that will perform a specific function or group of functions satisfactorily, with a minimum expense to the user in time, materials, and maintenance, and with due regard to economies in the manufacture of the machine itself. Correspondingly, the chief objective of the salesman is to induce the prospective purchaser to buy the machine, and to do so with the least expense in time and effort. The purchaser has a single object—to obtain a machine that will help him make the maximum profit on goods produced or services rendered.

Some time ago, I was talking to an important machinery builder who manufactures a most creditable line of machine tools, and he complained of the difficulty the salesmen had in selling his product, and of the high sales costs. This machine tool builder had had no experience himself in selling, and his principal contact with the market was through visits of customers to his plant. His policy was to allow his engineers, who designed the machines, to themselves evaluate and determine the exact characteristics of the machine to be built. The salesman's duty was to sell the machine as designed and built; failure to do so was evidence that the salesman was incapable.

There is no question that to some degree such a policy as this is still followed; but it is detrimental to the success of the machine builder. It is just as necessary for the machine designer to know what the purchaser requires as it is for the salesman to know the machine he is selling.

The Evolution of the Machine

If we consider the primitive machine, we find that at first the object was simply to produce a machine that would perform an operation faster than by hand—thus saving time. In quality of work, the designer endeavored to make his machine approach the quality of work done by hand. With the advance in the industry, there came a

Bernard Lester, assistant industrial sales manager of the Westinghouse Electric & Mfg. Co., has occupied a managerial position in the industrial sales department of the Westinghouse organization for over twenty-five years. Formerly, he was in charge of sales of small motors, chiefly to manufacturers of motor-driven appliances. At present, he is in general charge of sales of electrical apparatus to the industry.

Mr. Lester is a graduate of Haverford College, class of 1904, and has been on the board of trustees of that institution for several years. He has lectured at the University of Pittsburgh on industrial selling since 1931, and also, for many years, delivered lectures on the selling of industrial equipment to the students in the Westinghouse training course. He is author of the book "Industrial Equipment Marketing," and a member of the American Marketing Society and of the American Management Association.

continued improvement in the capacity of the machine, and greater accuracy was attained. Then came further improvements in the ability of the machine to do a combination of operations, and the addition of automatic features. Efficiency in the use of power, materials of production, and ease of maintenance were steadily sought for and realized. All these factors of improvement dealt with the ability of the machine to do the job, and do it rapidly, accurately, and economically—that is, with the functioning of the machine for the work intended.

But as these developments in design went on progressively, certain other factors, which we will call "factors related to people and plant," became recognized, desired, and increasingly pertinent. Machines had endangered life and limb through accident. Many of our earlier machines were looked upon as dangerous. A wave of sentiment swept through the country setting in motion legislation which has made the present-day machine remarkably safe in the hands of the operator.

Convenience for the operator, a factor earlier only considered from the viewpoint of machine output, came now to be regarded from the viewpoint of the operator. One machine which has been in use several years has been pointed out to me as inferior because of the tax it places upon the eyesight of the operator.

Some Other Factors that the Machine Designer is Called upon to Consider

Machinery is used under varying climatic conditions at home and abroad. Climatic and atmospheric conditions peculiar to certain process industries present other problems to the designer. One manufacturer employing some non-metallic parts in a machine used in tropical countries found a change in materials necessary on account of destructive insects. In some foreign countries, transportation conditions are extremely difficult, and it is even necessary to design large machines in detachable units of limited size and weight, so that they can be transported to the user disassembled. Furthermore, in some countries, the habits of machine operators differ considerably from those in this country, and their likes and dislikes create new design problems.

Manufacturing shops have become more orderly and are more systematically arranged and operated. With this has come an increased demand for cleanliness on the part of the machine. With higher factory standards, greater attention is given to decreasing the causes of dust and dirt and to the positive elimination of these in the atmosphere—largely for the comfort and health of the worker. Most machine shops have been noisy. Noise is found to impair the efficiency and comfort of the worker. A machine that operates silently appeals to the purchaser as being one that is efficient and durable.

In recent years, the appeal to the eye has become more important in machine design. Art in everyday life is now a dominant factor. Beauty in a machine was ridiculed a few years ago. Today, with a more general understanding of things mechanical, promoted largely by the automobile and the machinery used in office, store, and shop, we are asking for features that please the eye. Our advertising experts have seized upon the new psychology of appearance. The alert designer must give close consideration to outline, finish, and color.

"Mainly a Matter of Appearance" May Decide the Attitude toward a Machine

I was going through a metal-working plant recently, and the superintendent pointed out to me a certain machine. "What do you think of that?" he said. "Does it not operate satisfactorily?" I asked. "Oh yes," was his answer, "but it is a big noisy machine, and ugly at that." And then he told me that, although the machine had been installed only a few years, smaller, quieter operating, and more attractive machines were now available from other makers.

Later, in the same plant, we came upon an automatic lathe which had recently been installed. I asked the operator what he thought of it. "It's a peach," he said, and he pulled out of his apron pocket a piece of waste to wipe off some grease spots on the frame. He took pride in the machine. Its simplicity, beauty of outline, and subdued, but attractive finish created customer acceptance. I could see, too, that this machine would receive greater care than the other machine, which would benefit both the user and the builder.

Every designer should take a critical attitude toward his brain child. A pedestal grinder should look like what it is—for it is dangerous to try to force upon the public a machine having a radically different appearance. The addition of features wholly for the sake of appearance destroys confidence. On the other hand, conformity to changing public taste maintains confidence. There is conclusive evidence that appeal to the eye now constitutes a factor that very definitely aids in the acceptance of the machine, and, consequently, decreases cost of distribution.

With the enormous pent-up buying power existing in the country at present, and the words "obsolescence" and "modernization" heralded in the press, our eyes are turned to a study of those factors that make machines obsolete. In addition to the ability of the modern machine to do its work better, there are a multitude of factors that must be considered because the psychological attitude has changed.

Not long ago the superintendent of a factory in the East engaged in building instruments purchased a number of small bench lathes. They were well made and capable of most accurate work. No attention, however, had been paid to the external

finish of the machines. They were installed, and immediately production from the men and women operators fell off. The superintendent analyzed the situation and decided to remove the machines. They were taken to the tool-room and carefully finished, so that the whole external appearance of the machine corresponded to the atmosphere surrounding highly refined production. The machines, after a brief interval, were again installed and gave entire satisfaction. In the essential elements, no change whatsoever had been made in them; but they had been changed in features that affected the mental attitude of the operators.

Many machine designers establish in their own minds what features to incorporate in their design. Whether their ideas are right or wrong depends upon whether they reflect their purchasers' ideas and tastes. The skilful designer is continually studying user preference, and the machinery salesman can serve a very definite purpose in interpreting to him these changing preferences.

The characteristics of the machine that we have termed "related to plant and people" are being steadily introduced in recent years. They are becoming of greater relative importance in the eyes of the purchaser, and, consequently, to a greater degree are affecting customer acceptance of the machine. Since this is true, they have a definite effect on successful and economical distribution.

Human Preference Plays a Part of Constantly Increasing Importance

The human factor in the *operation* of a machine has, with the development of the machine and its progress toward a completely automatic unit, been a steadily decreasing one. On the other hand, when we consider the factory as a living and operating unit, the human factor is one that is becoming of increasing importance in the *selection* of machines. Today, the comfort, health, well-being, and tastes of those who supervise and operate machinery are vital. The successful designer is, therefore, giving more attention to those features that will appeal to the user from these viewpoints. The factory is becoming to an increasing degree a part of modern life, and the selection of machinery for factory equipment now goes beyond the mere ability of the machine to perform its specific duty in a process cycle.

Even prior to the business depression, builders of woodworking machinery were experiencing a decrease in demand, due to the introduction of other materials in place of wood. One progressive machinery builder in this field recognized that the wood planer was an awkward and ungainly machine, presenting some danger to the operator. In a largely disappearing market, he selected a machine of a size that was formerly popular, and redesigned its structure, introducing what is now termed a "streamline" design, and concealing the mechanism. The acceptance of the new design was immediate, and for some time after it was introduced, the company booked orders for this type and style of machine that taxed the factory output.

The foregoing paragraphs briefly indicate the many varying factors that the designer must consider in order to create a machine that will meet present-day demands. It is not possible any longer to reason wholly from a utilitarian point of view. The trend of the times in matters of appearance, safety, operator convenience, accessibility, finish, and color must also be considered.

* * *

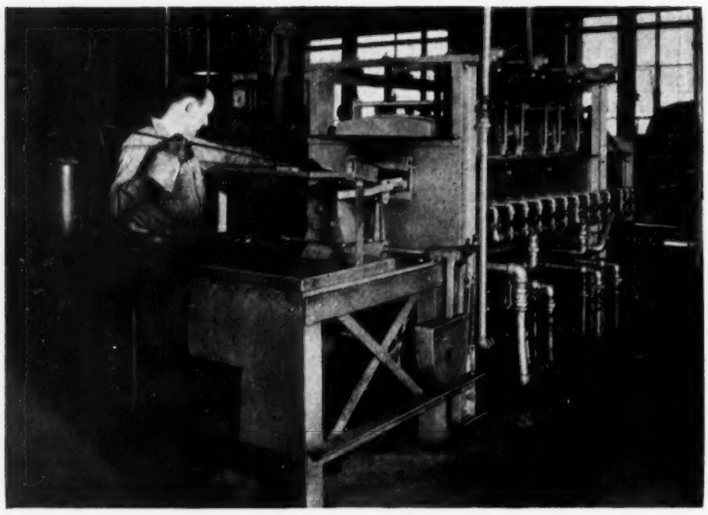
Machine Tool Building in Soviet Russia

There are at the present time in Soviet Russia twelve plants specializing in the building of machine tools and thirty-eight other plants manufacturing other kinds of machinery that also build machine tools. The total number of machine tools built in 1934 was 19,763. During the year, forty types of machines not previously built in Russia were produced, including special sizes of engine lathes, tool-room lathes, relieving lathes, slotting machines, semi-automatics, single-spindle automatics, gear-generating machines, horizontal boring and milling machines, planers, universal and horizontal milling machines, two-spindle planer type milling machines, radial drills, and horizontal grinders. Seventy-seven per cent of the machines built were motor-driven. The average horsepower per machine, considering all classes, was 8.6.

The small tool industry in Soviet Russia apparently made considerable progress in 1934. A number of tools not previously made in the country were produced, including threading hobs, milling cutters with inserted blades, reamers, high-speed twist drills, pneumatic tools, large size micrometers, thread gages, cutters for gear-cutting, and air chucks.

In the grinding wheel field, it is reported that progress was made in the production of thread-grinding wheels, cutting-off wheels, and fine-grained abrasive paper.

For 1935 the plans call for the production of 11,000 machine tools in the twelve plants specializing in this field. This represents an increase of about 30 per cent over the output of these plants last year. In addition to the larger number of machines to be built, it is expected that they will be of a higher quality and of a more complicated design. Among the machines these plants are expected to produce this year are crankpin lathes, axle-turning lathes, hydraulic shapers, four-spindle automatics, six-spindle automatics, internal high-production grinding machines, vertical turning and boring mills, horizontal boring and milling machines, multi-spindle milling machines, radial drills, and cylindrical grinding machines.



Heat-Treating on a Quantity

A Modern Heat-Treating Department Designed for the Economical Handling of a Large Variety of Work

HEAT-TREATING equipment designed for hardening and tempering a large variety of parts weighing as little as a few grains and as much as 5 pounds was recently installed in the plant of the General Household Utilities Co., Chicago, Ill., where Grunow electrical refrigerators are manufactured. This equipment was designed for versatility, in order to anticipate new lines of products or substantial changes in parts now being made. Low capital investment is another feature of this installation.

The increased furnace efficiency obtained with the new equipment has greatly reduced the amount of rejected work and effected considerable fuel economies. In hardening and tempering the rotor vanes of pumps, for example, work rejections have decreased as much as 90 per cent. These vanes are 2 7/8 inches long by 7/8 inch wide by 3/16 inch thick, and of a special cast iron.

The vanes are first heated to 1550 degrees F. and held at that temperature from seven to ten minutes, after which they are quenched in Rodman quenching oil. They are then tempered by heating to 800 degrees F., held at that temperature for three hours, and then allowed to cool in the air. These parts are carried through the first furnace loosely, but for the tempering operation they are screwed tightly on metal frames (sixty to a frame) to prevent distortion. Heretofore, scale produced during hardening prevented close and even contact of the vanes on the frames, and thus permitted distortion of the parts. With the close atmospheric control of the hardening furnace now being used, scale has been reduced to an almost negligible amount, so that this deterrent factor no longer exists, the result being a material improvement in the product.

Hardening Furnace Equipped with a Shaker Hearth

Two high-heat or hardening furnaces are installed in this heat-treating department. The hardening furnace used for the pump rotor vanes is of the shaker-hearth type and is equipped with a hearth 7 feet long by 13 inches wide. This furnace has a refractory-lined steel case 9 feet long, 3 feet wide, and 3 feet high.

At the charging end, seen in the heading illustration on this page, there is a steel stand that supports the feeding chute. The heated parts slide from the closed discharge end through an air-tight chute directly into the quenching tank. Nicking of the parts would occur if they were permitted to drop directly into the quench, and so the chute is baffled to break their fall. The construction of this furnace at the discharge end can be seen in the heading illustration on the opposite page.

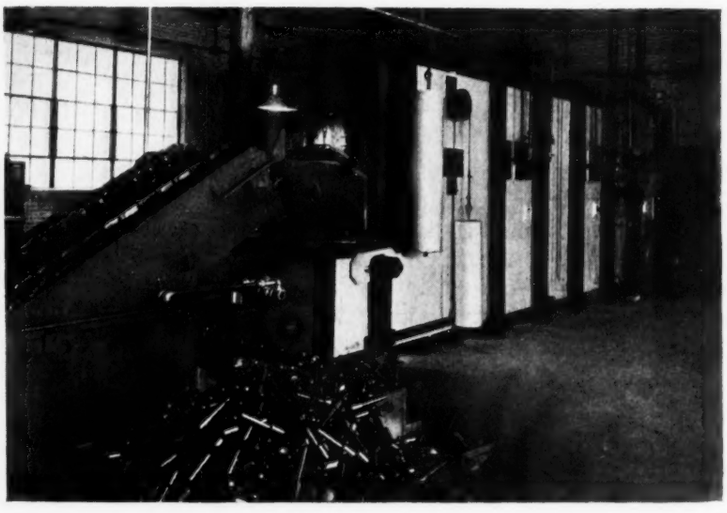
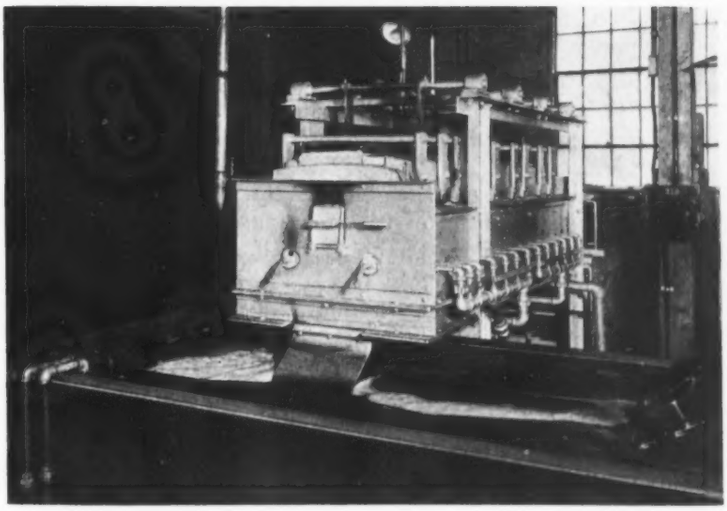


Fig. 1. A Flight Conveyor and Chute Carry the Work Pieces to the Steel Conveyor Belt of the Tempering Furnace

Diversified Work Production Basis

By
J. B. NEALEY



This furnace is provided with an alloy-steel hearth that is notched lengthwise to enable parts as small as needles to be handled conveniently. The hearth is suspended on four pairs of steel hangers, which are swung back and forth by a motor-driven cam and a lever. This method of suspension prevents vibration from being transmitted to the furnace proper.

The rate at which the work moves through this furnace can be regulated by changing the length of stroke, altering the frequency of the strokes, or by adjusting the spring-tension device that controls the force imparted by the strokes. The frequency of the strokes can be regulated through a variable-speed transmission.

Heat is supplied by twenty-six gas burners, thirteen on each side, which under-fire the hearth. Air pressure is employed to inspirate the gas. An automatic temperature control of the potentiometer type regulates the fuel flow through the medium of valves in both the air and gas lines, which are actuated by a single motor. A recording pyrometer is part of this equipment.

The steel quenching tank is 12 feet long by 4 feet wide. It rests in a larger tank that is equipped with coils for the circulation of cooling water. The smaller tank is open at both ends. A motor-driven propeller keeps the oil in motion. The work is carried through this quenching tank and out of it by means of a flight conveyor. When pump rotor vanes are handled, they are clamped on the frames as they leave this tank and placed on another flight conveyor which carries them to a chute leading into the tempering furnace.

The Tempering Furnace has a Conveyor Belt Constructed of Metal Segments

The tempering furnace, which is illustrated in Fig. 1, is also constructed of steel and refractory material. It is 27 feet long, 5 feet wide, and 8 feet high, and has a temperature range of from 300 to 1400 degrees F. The hearth consists of a conveyor made up of metal segments that are flat on top. These segments make a hearth that is rigid while carrying the work through the furnace, but that immediately becomes flexible when it passes over the pulleys at the ends of the furnace. The work is discharged at the closed rear end of this furnace by gravity through a chute that leads to a small opening located close to the floor.

Heat is supplied to this furnace by fourteen gas burners, seven on each side. They burn between a double arch, the lower portion of which is perforated to enable the heat to pass into the heating chamber by convection. Air pressure from a blower inspirates the gas. This furnace is equipped with a temperature

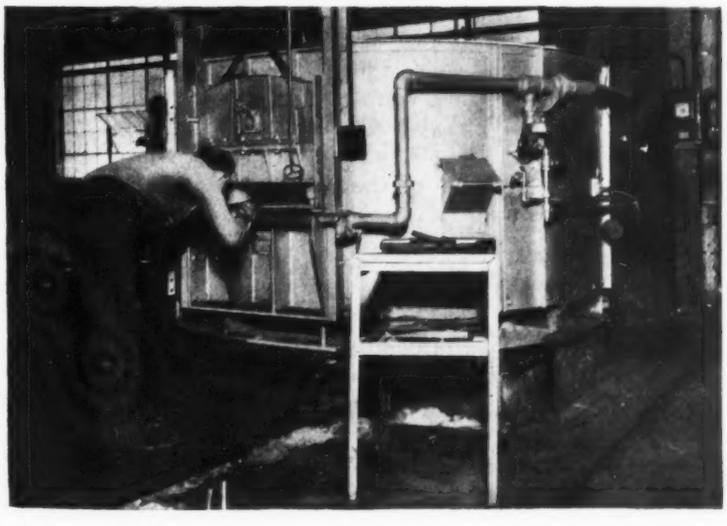


Fig. 2. Rotary Hardening Furnace which is Divided into Two Heating Zones — the High-heat and the Pre-heat Zones

control which actuates a motor-driven valve in the air line only. There is also a recording pyrometer.

Production and Fuel Consumption of the Hardening and Tempering Furnaces

The production of the high-heat furnace in handling the pump rotor vanes amounts to 1000 pieces, or 110 pounds, an hour, with a gas consumption of only 300 cubic feet. The production could be doubled with only a slight increase in the amount of fuel consumed. The same number of pieces are put through the tempering furnace in an hour, but in this case, the clamping frames, which weigh about 10 3/4 pounds apiece, bring the total weight up to about 288 pounds an hour. About 700 cubic feet of gas is consumed per hour by the tempering furnace.

Parts such as rotors, pump bodies, caps, etc., are hardened by heating in the doughnut-shaped rotary furnace illustrated in Fig. 2, and then quenching in the same tank as is used in conjunction with the furnace shown in the heading illustrations. The parts are tempered in the drawing furnace already described. The rotary furnace is 9 feet in diameter and 7 feet high. It is also constructed of a steel case, lined with refractory shapes.

A ring-shaped hearth revolves about a center pier of refractory shapes. The hearth is made up of refractory material mounted on a circular steel structure that is equipped with four flanged wheels running on a circular track. The hearth is motor-driven in a counter-clockwise direction through a pinion and a ring gear which encircles its base.

This furnace is divided by a wall into two heating zones, to the right and left of the single door through which the work is loaded and unloaded. Five gas burners are located in the left-hand half of the furnace, which is the high-heat zone. The hot products of combustion flow around into the other half of the furnace, or pre-heat zone. A temperature controller similar to the one used on the tempering furnace maintains the prescribed heat in this rotary hardening furnace. The temperature range in the furnace depends upon the type of material going through, and varies from 1500 to 1650 degrees F., but generally, the furnace is operated in the 1600- to 1650-degree range.

Terms Used in Electric Welding Practice

THE terms used in designating methods and equipment employed in electric welding are often misunderstood and frequently misapplied. Reference to the following definitions of welding terms approved as an American Standard by the American Standards Association will help to avoid some of the errors frequently made. The definitions in the following are quoted from bulletins of the American Institute of Electrical Engineers.

Expressions Used in Resistance Welding

Base (Parent) Metal—The material that is welded or cut.

Butt Welding—A resistance welding process wherein a butt joint is employed.

Flash Welding—A resistance butt-welding process wherein the welding heat is developed by the passage of current in the form of an arc across a short gap between the surfaces to be welded, these surfaces being kept slightly separated until they have flashed off to parallelism and have reached the desired temperature. The electrical circuit is then opened and the upsetting movement takes place. The operation of the machine may be manual, semi-automatic, or fully automatic. The name "flash" arises from the fact that during the heating period oxidizing metal is thrown off in a shower of sparks.

Percussive Welding—A resistance welding process wherein electric energy is suddenly discharged across the contact area or areas to be welded and a hammer blow is applied simultaneously with or immediately following the electrical discharge.

Pressure Welding—A process of welding metals in either the highly plastic or fluid state by the aid of mechanical pressure. This process includes the resistance welding form of electric welding and the pressure type of thermit welding.

Resistance Welding—A pressure welding process wherein the welding heat is obtained by passing an electric current between the contact areas to be welded.

Seam Welding—A resistance welding process wherein the weld is made lineally between two contact rollers or a contact roller and a contact bar.

Spot Welding—A resistance welding process wherein the weld is made in one or more spots by the localization of the electric current between the contact points.

Electric Arc-Welding Terms

Anode Drop—The voltage drop between the arc stream and the positive electrode.

Arc Stream Voltage—The voltage across the gaseous zone, which varies with the length of the arc.

Arc Welding—A fusion welding process wherein the welding heat is obtained from an electric arc

formed either between the base metal and an electrode or between two electrodes with or without the use of gases.

Arc Welding Electrode—Filler metal in wire or rod form, or a carbon (or other suitable material) rod, used as one (or both) of the terminals in an electric circuit in order to produce a welding arc.

Atomic Hydrogen Welding—A fusion welding process wherein the heat of an electric arc between two suitable electrodes is used to dissociate molecular hydrogen into its atomic form, which on recombination in the molecular form gives up the energy required to dissociate it, producing a flame of very high temperature and at the same time bathing the molten metal in hydrogen. It may be considered as a combination of the gas and arc welding processes.

Automatic Weld—A weld made with equipment which automatically controls the entire welding operation, including the feed of the welding wire and the passage of the arc along the weld.

Bare Electrode—A metal electrode which is not fluxed or covered.

Base (Parent) Metal—The material that is welded (or cut).

Carbon Arc Cutting—A process of severing metals by melting with the heat of a carbon arc.

Carbon Arc Welding—An arc welding process wherein a hard carbon or graphite electrode is used, and filler metal, if required, is supplied by a welding rod.

Carbon Electrode—The electrode used in carbon arc welding and cutting.

Cathode Drop—The voltage drop between the arc stream and the negative electrode.

Coated Electrode—A fluxed electrode having the flux applied externally by dipping, spraying, painting, or similar methods.

Composite Electrode—A fluxed electrode having one or more filler materials combined mechanically with the flux or covering.

Covered Electrode—A metal electrode having an external wrapping or braiding of paper, asbestos, or other material. A flux may be included with the covering.

Electrode Drop—The voltage drop in the electrode due to its resistance (or impedance).

Filler Metal—The material that is added to the base metal to produce the weld in some forms of the fusion welding process. (See "Welding Rod" and "Arc Welding Electrode.")

Flux—Material used in welding to prevent the formation of oxides, nitrides, or other undesirable inclusions in the weld and to eliminate those that have formed. In metal arc welding, it is also employed to aid in the retention of the various elements of the electrode and to retard the rate of cooling of the weld metal.

Fluxed Electrode—A metal electrode provided with a flux.

Flux Encased Electrode—A fluxed electrode having the flux between a metal core and a sheath.

Fusion Welding—A process of welding metals in the molten, or molten and vapor state, without the application of mechanical pressure or blows.

Manual (Hand) Weld—A weld made by an operator unaided by any mechanical guiding device.

Metal Arc Cutting—A process of severing metals by melting with the heat of a metal arc.

Metal Arc Welding—An arc-welding process wherein the electrode used is a metal rod or wire, which, when melted by the arc, supplies the filler metal in the weld.

Metal Electrode—The electrode or one of the electrodes used in metal arc welding and cutting.

Semi-automatic Weld—A weld made with a device that automatically controls the feed of the welding wire, the manipulation of the wire being controlled by hand.

Shielded Carbon Arc Welding—A carbon arc welding process wherein the molten filler and weld metals are effectively protected from the air by supplemental means.

Shielded Metal Arc Welding—A metal arc-welding process wherein the molten filler and weld metals are effectively protected from the air by supplemental means.

True Arc Voltage—The summation of the arc stream voltage, the cathode drop, and the anode drop. It is determined by deducting from the welding arc voltage the drop in the electrode and the contact drop between the electrode-holder and the electrode.

Weld—A localized consolidation of metals.

Welding Arc Voltage—The total voltage between the electrode-holder and the base metal immediately adjacent to the arc terminal. It is the summation of the arc stream voltage, the cathode drop, the anode drop, the drop in the electrodes, and the contact drop between the electrode-holder and the electrode. (In the case of the Zerener process employing two electrodes the welding arc voltage is the total voltage between the two electrode-holders.)

Welding Rod—The filler metal, in wire or rod form, used in the gas-welding process and those arc-welding processes wherein the electrode does not furnish the filler metal.

Weld Metal—The material composing the weld.

* * *

Course in Diesel Engineering

The Extension Division of the University of California, Berkeley, Calif., announces that the University has developed an inexpensive correspondence course in Diesel engineering with a view to furnishing the practical man with information pertaining to the fundamental principles of Diesel engines, and assisting him in the operation and maintenance of Diesel equipment. For further details, address the University of California, Extension Division, 301 California Hall, Berkeley, Calif.

Engineering News Flashes

The World Over

1,200,000 Revolutions per Minute

According to an item published in *Esso Oil-Ways*, the highest rotating speed ever attained is 1,200,000 revolutions per minute, with the rotating part resting in a bearing of hydrogen. This high speed was obtained in a purely experimental device constructed by Dr. J. W. Beams of the University of Virginia. It was a diminutive centrifuge in which the tiny rotor was spun by means of a stream of hydrogen impinging upon flutes in the rotor. When the rotor once attained its speed, it rested entirely in a bearing of hydrogen.

Elektron Alloy Air-Propeller Blades

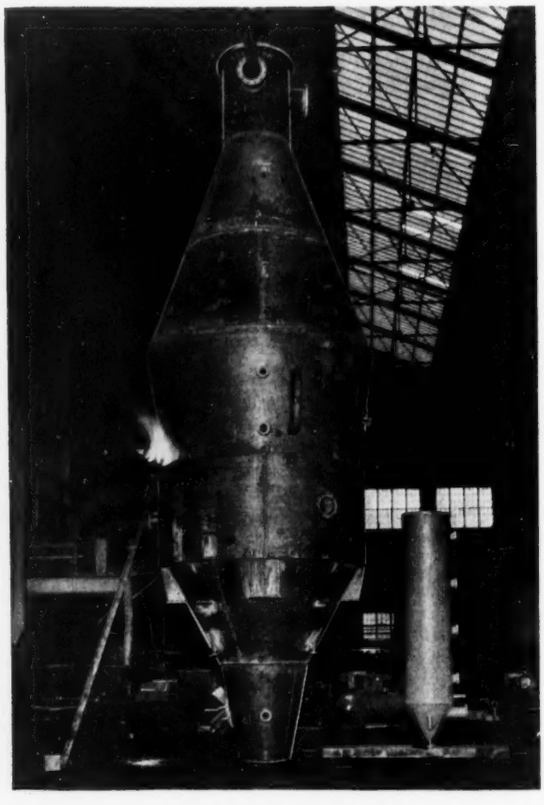
Elektron alloy—a light-weight alloy containing magnesium—has recently been used for forged air-propeller blades by the Bristol Aeroplane Co., Ltd., of England. The forgings were made by James Booth & Co., Ltd. The blades have been tested over a period of time on engines ranging from 500 to 600 horsepower, and at speeds between 1000 and 1100 revolutions per minute, with satisfactory results. The application is said to be of particular importance in view of the use of variable-pitch air propellers, requiring the use of the lightest possible material.

Huge Hydrogen-Cooled Machines

Two of the world's largest hydrogen-cooled synchronous condensers will be built by the General Electric Co. for the City of Los Angeles, to be installed at the receiving end of the 270-mile transmission line from Boulder Dam. These machines will be rated at 60,000 KVA., 13,800 volts, 60 cycles. Hydrogen-cooling results in materially reducing windage losses, with a corresponding saving in operating expense. The machines will be installed outdoors.

New Enameling Process Improves Quality at Less Cost

The Mellon Institute at Pittsburgh announces the development of a new porcelain enameling process known by the trade name "Hommelaya," which will find wide application, particularly in the



To provide salt for the American table, this 25-ton evaporator was built by the Wellman Engineering Co., Cleveland, Ohio, by shielded arc welding, for one of the country's largest salt manufacturers. It is about 50 feet high and 12 feet in diameter at its widest point. Photograph by courtesy of the Lincoln Electric Co., Cleveland

manufacture of automatic refrigerators, washing machines, and other domestic equipment. With two coatings and firings, a better quality of enamel is said to result than is possible with the three coatings and firings required in present processes. Briefly, the advantages claimed are a better quality product, which is less likely to chip; an important saving in cost of materials; a saving of one-third in fuel and labor costs; a 50 per cent increase in productive capacity of present enameling kiln equipment; and a smaller percentage of rejections. The process has been applied under actual industrial conditions in several manufacturing plants.

Sending Mine Equipment by Air

A complete milling and treatment plant for gold mining has recently been erected in Peru, the entire equipment for which was carried by airplane for the last sixty-five miles of the journey to its destination 14,000 feet above sea level. The difficult nature of the country made air transportation the only possible form of shipment.

World's Largest Diesel Locomotive

The Santa Fé Railroad has just put in operation the most powerful Diesel locomotive ever built. If the exhaustive tests to be made with this engine prove successful, it will be used for the road's finest through train, *The Chief*, running between Chicago and California, a distance of 2225 miles. A faster schedule than the present will be adopted.

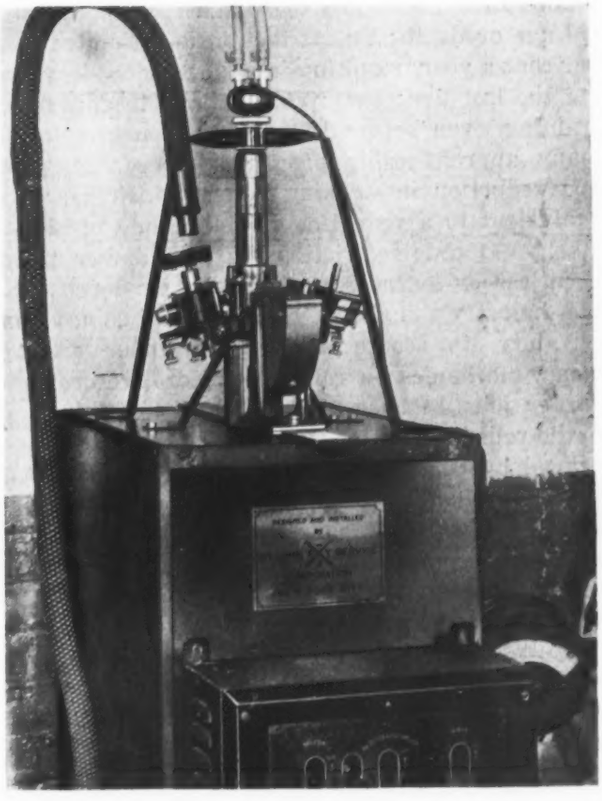
The engine, built by the Electro-Motive Corporation, is rated at 3600 horsepower. It weighs 240 tons and has an over-all length of 127 feet. Actually, it is a multiple unit of two identical sections, which can be operated singly or together, or coupled to any desired number of similar units, all of which are controlled by one locomotive engineer. It thus marks a great step along the road of applying flexible Diesel power to any kind of train on main line service. The new locomotive is unique in appearance. It has a pleasing effect of streamlining, obtained through steel jackets that hide every detail of engineering apparatus.

Largest Stainless Steel Conveyor Belt

A flexible stainless conveyor belt of dimensions larger than any previously made has been produced by the Sandvik Iron & Steel Works, Sandviken, Sweden, for a large European sugar mill. This steel belt is 12 feet wide and is designed to carry a load of approximately one ton per running foot.

A New Electroplating Process

A new electroplating process which deposits a bright zinc surface on steel articles, said to be the first commercial process for the bright plating of zinc, has been developed by E. I. du Pont de Nemours & Co., and is known as the Du Pont "Bright Zinc" process. The new process will be publicly demonstrated for the first time at the National Metal Exposition in Chicago, September 30 to October 4. It is expected that it will be widely used in the automobile and radio industries, and may also be used for household appliances and equipment, airplane parts, builders' hardware, washing machine parts, etc.



This X-ray equipment was designed and built by the St. John X-Ray Service, Inc., 30-20 Thomson Ave., Long Island City, N. Y., for use in the firm's own laboratory. Instead of utilizing a gas tube operated by a vacuum pump, the new equipment uses research tubes with molybdenum, copper, and cobalt targets

EDITORIAL COMMENT

Industry Reports a Shortage of Skilled Workers

It seems paradoxical that there should be a shortage of skilled men in the metal-working and machine-building industries at a time when there is so much general unemployment. Yet this seems to be the case. The National Industrial Conference Board, in a recent report, mentions that 287 metal-manufacturing companies employing over 115,000 wage-earners reported a shortage of 1193 skilled men. In the metal-working industry as a whole, the shortage of skilled workers is estimated at over 19,000. When this industry resumes normal operations, the report points out that the shortage will be somewhere in the neighborhood of 125,000.

Some of the important factors that have brought about this shortage of highly skilled mechanical workers are: (1) The tendency to develop single-machine operators for special machines, in place of all-around mechanics; (2) abandonment of industrial employment by skilled men in favor of other occupations; (3) deterioration in skill of many older workers through prolonged unemployment; (4) reduction in the supply of skilled labor because of old age or death; this reduction is estimated at 5 per cent a year, resulting in a 25 per cent loss during the last five years; (5) inadequate apprentice training, even before 1930, and the suspension of many apprenticeship programs since that time; (6) reduction in working hours, which has been equivalent to a reduction in the supply of skilled labor; (7) code restrictions on the number of apprentices or learners who can be employed; (8) the industry's inability, because of business uncertainty, to assure steady, continuous employment; mechanics on relief, therefore, refuse temporary jobs, because of the difficulty of returning to the relief rolls after leaving them; (9) the withdrawal by Government enterprises, such as navy yards and public work projects, from industry of some of its skilled labor, because of industry's inability to compete with the Government wage scales and the assurance of more continuous work on Government projects.

With a view to overcoming some of these difficulties, the following suggestions have been made: (1) A change in the limitations of working hours; (2) a change in the method of granting public relief, so as to make the receipt of relief much less attractive than employment in private industry; (3) placing the wage scales on public relief work in line with actual prevailing wage levels, so as to eliminate Government competition for skilled labor; (4) allocation of part of the Government expenditures for work relief to finance the training of unemployed, unskilled labor and to retrain those whose skill has been reduced through unemployment; (5) further improvements in machine shop equipment, so as to reduce the need for skilled labor; (6) the establishment of comprehensive and efficient systems of apprentice training on the part of all industry.

Attention Must be Given to the Matter of Trade Training

To make such training effective, the industrial employers who cooperated with the National Industrial Conference Board in making this survey voiced the opinion that apprenticeship must be made more attractive than in the past, by assuring the apprentice an all-around mechanical training, and offering prospects of a satisfactory earning power, stability of employment, and opportunity for advancement. To make a long-time program effective, the Conference Board points out, a coordinated effort of industry is essential.

Spending Profits on Unprofitable Business

At times it is supposed to be profitable, in the broader sense of the word, to take business at a loss; but this should not be done without a careful scrutiny of all the factors involved. It often happens that the profits on one part of a company's sales are spent in obtaining other business that is unprofitable. In other words, many firms spend part of their profits in making up the losses on orders that should not have been accepted in the first place. Too often the total volume of business is the gage by which the sales manager's ability is measured; but, after all, it is the return on the capital invested that counts.

During recent years, more attention has been given to this question than formerly. Some firms have found that their total profits are actually greater on a fractional volume of the business done than on the maximum volume obtainable.

Ingenious Mechanical Movements

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and Other Devices

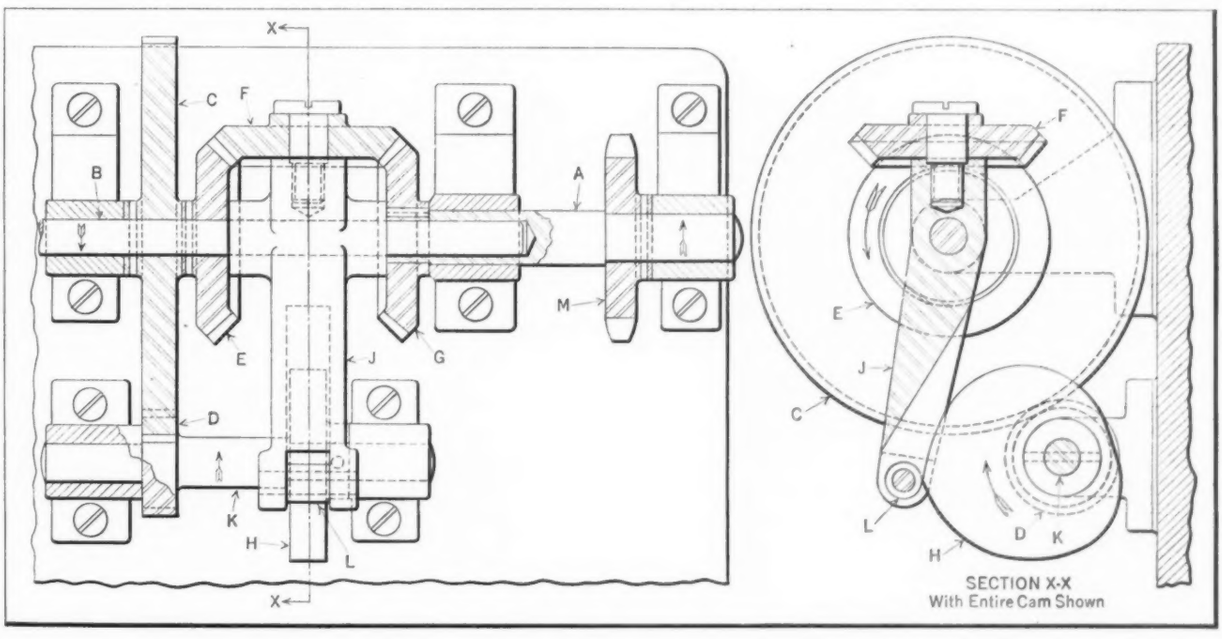
Combination Cam and Differential Gear Movement for Chain Conveyor

By J. E. FENNO

Sprocket chain conveyors are used extensively for conveying containers through filling machines, and frequently the drive is arranged so that the chain dwells at regular intervals to permit the filling of the containers. One rather interesting drive for obtaining this intermittent conveyor movement is shown in the illustration. Its design embodies a cam which transmits a rocking movement to a differential planet gear for controlling the rotation of the driving sprocket of the conveyor chain. This mechanism has its application in a machine for filling glass vials with liquid. To prevent the spilling of the liquid from the vials as they pass along on the conveyor, provision is made to eliminate shock in stopping and starting the chain.

The intermittent movement is transmitted to the sprocket shaft *A* from the constantly rotating drive shaft *B* through the spur gears *C* and *D*, miter gears *E*, *F*, and *G*, and also through the cam *H*. Gears *C* and *E* are pinned to the drive shaft, the end of which turns freely in the end of the driven shaft *A*. On this shaft is keyed gear *G* which meshes with gear *F*. Gear *F* is mounted on the arm *J*, which is free to turn on shaft *B*. The outer end of arm *J* carries a follower roll *L* which engages the cam *H*, the latter being pinned to the pinion shaft *K*. In order to synchronize the conveyor movement with that of the rest of the machine, each intermittent cycle of the conveyor chain must occur during one-quarter revolution of the drive shaft *B*.

There are four vial stations to each length of conveyor chain equivalent to the pitch circumference of the sprocket. Hence, in order to cause the chain to dwell as each station passes the filling valve, the sprocket *M* must dwell after each quarter revolution. It was found by experiment that a vial could be filled in the same time that it takes shaft *B* to rotate one-eighth revolution. Thus, having determined the angular movement of this shaft during the dwell period, it remains to proportion the



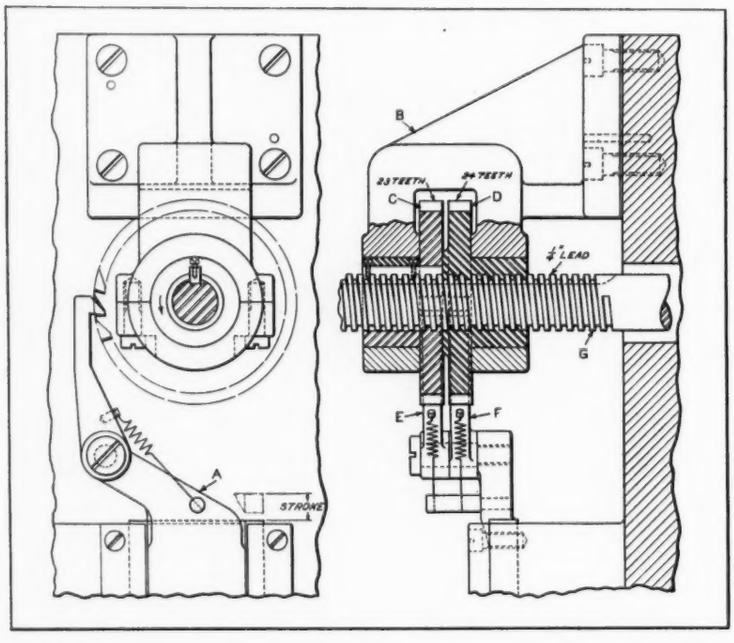
Sprocket Drive for Conveyor with Mechanism that Causes Conveyor to Dwell at Operation Stations without Starting or Stopping Shock

gears and cam to impart the required rocking motion to arm *J* for obtaining this dwell; that is, to cause gear *F* to roll on gear *G* without rotating the latter and the sprocket.

Assuming that arm *J* is stationary, one-eighth revolution of gear *E* in the direction of the arrow would rotate gear *G* the same amount in the opposite direction. Now suppose that during this one-eighth revolution of gear *E*, arm *J* were rotated one-sixteenth revolution in the same direction. Then gear *F* would merely roll on gear *G* and the latter would remain stationary. Since we know the movement of arm *J* required to cause gear *G* and sprocket *M* to dwell during one-eighth revolution of the drive shaft, the contour of the cam can be developed. The throw of the cam will, of course, correspond to the angular movement of the arm. One complete cycle of the cam is required for each one-quarter revolution of the drive shaft. Therefore, the ratio of gears *C* and *D* must be 4 to 1.

Thus, while the drive shaft *B* rotates one-eighth revolution from the position shown, the cam will rotate one-half revolution and gear *F* will roll on gear *G*, causing the latter and the sprocket to dwell. During the next one-eighth revolution of shaft *B*, however, the cam will complete its revolution, swinging the arm in the opposite direction and causing gear *F* to rotate gear *G* one-quarter revolution, or twice the amount it would rotate if arm *J* were stationary. In this way, it will be seen that shafts *B* and *A* have the same angular movement for each station movement, although shaft *A* rotates at a higher velocity, owing to lost motion resulting from its dwell.

By observing the contour of the cam, it will be noted that it is developed to impart a constant rise for the first half revolution. This constant rise is important if a steady dwell is to be obtained. For the remaining half of the cam, the contour is such that the beginning of the upward movement of the arm is accelerated and then retarded at the top. This accelerating and retarding of the arm, when transmitted through the gears, results in a corresponding movement being imparted to the conveyor chain, the shock to the chain being so slight that spilling of the liquid in the vials does not occur. The working torque transmitted through the gears is sufficient to maintain engagement of the follower roll on the cam.



Ratchet Mechanism for Imparting Slow Movement to Feed-screw

Differential Ratchet for Imparting Slow Axial Movement to Feed-Screw

By F. E. JUDSON

In designing machines, it is sometimes necessary to make provision for transmitting an intermittent rotary movement to a feed-screw from a reciprocating slide. For a comparatively large angular movement of the screw, an ordinary ratchet arrangement is suitable, but for an extremely small angular movement, such as that required for the feed-screw illustrated, special means must be provided.

The screw *G* provides the transverse feed for the wheel of a surface grinding machine used in grinding wood planer knives. It has the very short axial movement of 0.00045 inch for each cycle of the reciprocating slide *A*. To obtain the desired feed, two ratchet wheels *C* and *D*, operating on the differential principle are used. One wheel has 23 teeth and the other 24. Axial movement of both wheels is prevented by the bracket *B* fastened to the machine. This bracket also forms the bearings for the wheels. It will be noted that wheel *C* is provided with a feather key which engages the spline in the screw and that the screw is free to slide axially in this wheel. The bore in wheel *D*, however, is threaded to engage the screw. The angular movement is imparted to the ratchet wheels by their respective pawls *E* and *F*, pivoted to the slide *A*.

In explaining the action of this mechanism, let us assume, for simplicity, that both ratchet wheels have the same number of teeth. Thus, for every cycle of slide *A*, both the wheels, as well as the screw, would rotate together. Consequently, there would be no axial movement of the screw. Now returning to the actual case, wheel *C* has one less tooth than wheel *D*. Therefore, during one cycle of the slide, pawl *F* will rotate wheel *D* 1/24 revolution. Owing to the difference in the number of teeth, how-

ever, wheel C will be rotated by pawl E 1/23 revolution; and the axial movement of the screw will be equivalent to the difference between these two movements multiplied by the lead of the screw, or:

$$\left(\frac{1}{23} - \frac{1}{24}\right) \frac{1}{4} = 0.00045 \text{ inch}$$

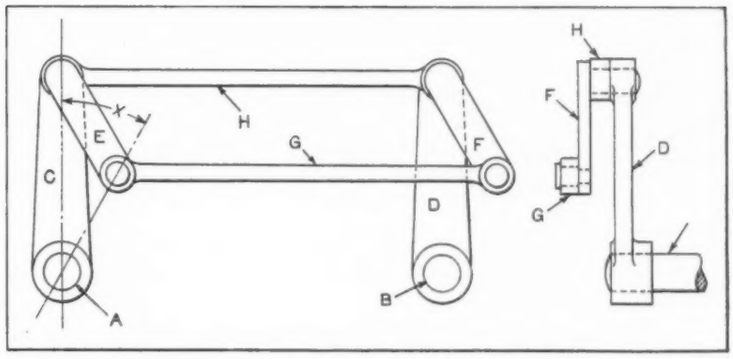
Perhaps it should be mentioned here that, in so far as the preceding description is concerned, both pawls could have been incorporated into one wide pawl encompassing both wheels. However, the requirements of the machine were such that a faster feeding movement of the screw was required for certain jobs. To accomplish this, the pawl E is swung to the left to clear wheel C and held in this position by a latch. A plunger is then released which locks wheel C to prevent its rotation. All movements for disengaging and locking the wheel are obtained by shifting one lever. However, the latch, plunger and operating lever are not shown. With the pawl E disengaged, one cycle of the slide will cause only ratchet wheel D to rotate, its angular movement being 1/24 revolution. The corresponding movement imparted to the screw is approximately 0.010 inch.

Crank Motion with Dead Center Eliminated

By L. KASPER

When a rotary motion is transmitted from one shaft to another by means of cranks and a connecting-rod, a flywheel is usually employed on the driven shaft to carry the crankpin past the dead center positions. In the arrangement shown in the illustration, no flywheel is required. Although the principle is not new, the writer believes that the arrangement is somewhat out of the ordinary, and it could probably be applied in many cases where the added weight of a flywheel is objectionable.

The arrangement shown was used in a wire-forming machine to transmit power between two shafts located some distance apart. The purpose of the auxiliary rod G is to carry the driven shaft past the dead center positions. The question may be raised as to why a crank motion is used when a chain drive would produce the same effect. The reason is that on the machine in question, a reciprocating part of the machine passes into the space between the two shafts while the connecting-rods are "running over," or passing through the upper half of their cycle of rotation, withdrawing as the rods approach the center position. Obviously, this arrangement would be impossible with a chain or gear drive, which remains in the same position at all times.



Crank Motion with Auxiliary Rod that Eliminates Dead Center Effect

Referring to the illustration, the shafts A and B carry the crank-arms C and D, respectively, which are connected by the rod H that runs free on its crankpins. In the actual installation, rods G and H were longer than shown. The length of these rods, however, does not affect the operation of the drive. The upper crankpins, which are keyed to the crank-arms C and D, carry the auxiliary arms E and F, which are set at an angle with arms C and D. Connecting-rod G, which is exactly the same length as rod H, connects arms E and F. Although this arrangement may be classed as being without a dead center, it really has two dead center positions, but there is a time element between the two which renders them both ineffective in arresting the driving motion. When one crankpin reaches dead center, the other is still approaching and is effective in forcing the first past the dead center.

It is essential that each pair of similar parts be of exactly the same length; otherwise, there will be a binding action. Although the length of arms E and F should be kept as short as possible for the sake of compactness, they should not be less than one-half the length of arms C and D. The writer has found that the movement will operate without any dead center effect over a wide range of positions for arms E and F, although the smoothest movement seems to be attained when the angle X is not less than 20 degrees.

* * *

Adequate Information with Orders

"How Equipment Manufacturers Provide Against Inadequate Specifications in Customers' Orders" is the name of a pamphlet recently published by the Policyholders' Service Bureau of the Metropolitan Life Insurance Co. of New York City, copies of which are available on request to the Service Bureau. Briefly, this booklet answers the question: "What methods are used by manufacturers, particularly machinery manufacturers, to obtain the necessary details regarding customers' orders, so that the goods, when shipped, will meet the customers' requirements?"

Laying Out Hobs for Spline Shafts

Method and Calculations for Determining the Form of the Teeth of Hobs for Spline Shafts

By EARLE BUCKINGHAM, Professor of Mechanical Engineering
Massachusetts Institute of Technology, Cambridge, Mass.

THE usual method of determining the form of the cutting edge of hobs for spline shafts is to roll the particular spline shaft as a gear, and thus develop the form of its corresponding basic rack. This is done on the drawing board, with the spline shaft suitably enlarged.

The first problem to be solved is the position or size of the pitch circle for the spline. If it is too large, a troublesome fillet will be produced at the bottom of the spline. If it is too small, the top of the face of the spline will be rounded or beveled off.

When a calculating machine is available, the forms for the cutting edges of these hobs may be established analytically, to any degree of accuracy desired, in much less time than is required to obtain the same results, to a lesser degree of accuracy, by a geometrical lay-out.

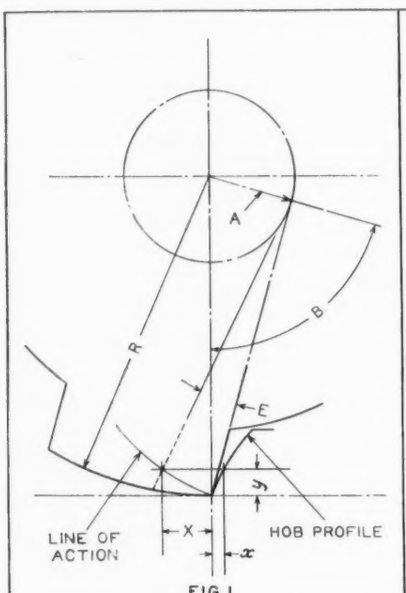


FIG. 1

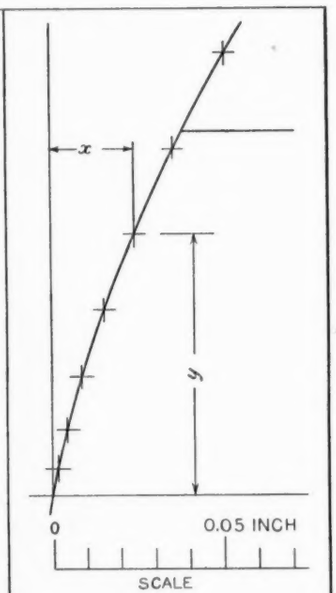


FIG. 2

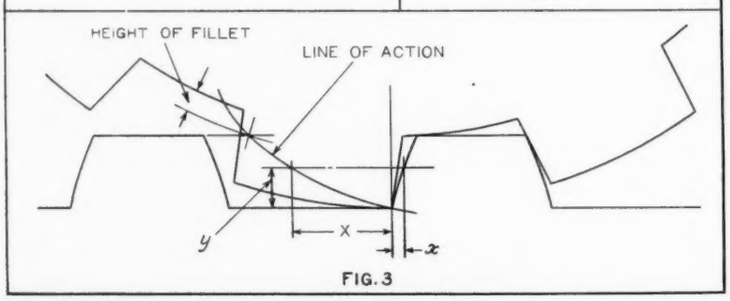


FIG. 3

Referring to Fig. 1:

A = half thickness of spline;
R = pitch radius of spline;
y = ordinate of line of action and hob profile;
X = abscissa of line of action;
x = abscissa of hob profile; and
E = angle of rotation (chosen arbitrarily).

Then,

$$\text{Cos } B = \frac{A}{R}; \; D = B - E$$

$$y = \cos D \; (R \cos D - A)$$

$$X = \sin D \; (R \cos D - A)$$

$$x = R \text{ arc } E - X$$

As an example, take the S A E 1 1/2-inch, ten-spline shaft. Use the outside radius as the pitch radius. This gives the following values:

$$A = 0.115; \; R = 0.750$$

Then,

$$\text{Cos } B = \frac{0.115}{0.750} = 0.15333 \text{ and}$$

B = 81 degrees, 10 minutes, 48 seconds

Select successive values of E varying by 3 degrees. The calculations are shown in the accompanying table.

The coordinates x and y of the hob tooth profile may be plotted to any enlarged scale desired, say 100 times the size. A curve may then be drawn through these points. From this graph, the series of coordinates needed in the shop to make the form tool can be readily measured. In Fig. 2 is shown an enlarged graph of this profile.

The thickness of the hob tooth at the pitch line would be determined as follows:

N = number of splines;
R = pitch radius of spline shaft;

Figs. 1 to 3. Notation, Hob Profile and Lay-out for Hobs for Spline Shafts

Fig. 4. Fillet at the Root Practically Eliminated. Fig. 5. Hob for Cutting Grinding Clearance at the Root of the Spline

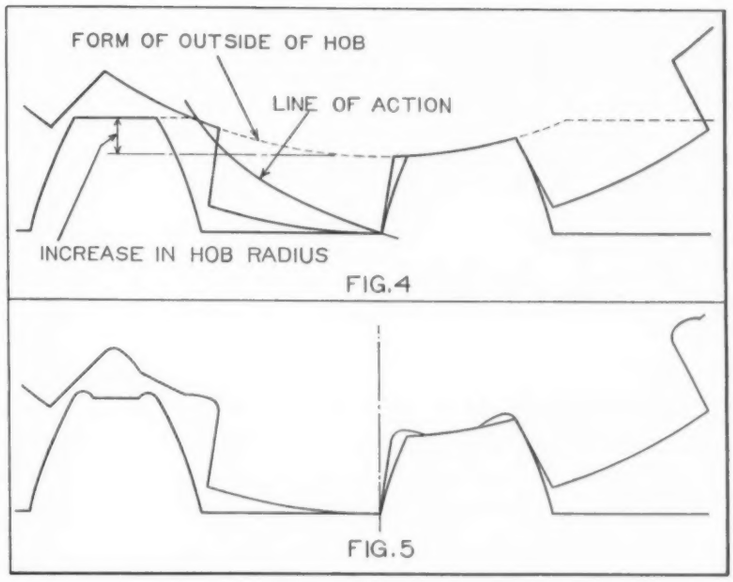


FIG. 4

FIG. 5

A = half thickness of spline; and
T = thickness of hob tooth at pitch line.

$$T = \frac{2\pi R}{N} - 2A$$

In the foregoing example, $N = 10$; $R = 0.75$; and $A = 0.115$. Then,

$$T = \frac{6.2832 \times 0.75}{10} - 0.23 = 0.2412$$

This hob tooth profile, line of action, and a section of the spline shaft are shown in Fig. 3. The height of the fillet at the bottom of the spline can be determined, as indicated, by measuring the distance along a radial line of the spline shaft between the intersection of the line of action and the line representing the tops of the hob teeth and the root of the spline.

The fillet at the root may be practically eliminated by making the hob over size and cutting away in a circular form the outside diameter at the middle, as shown in Fig. 4. The minimum amount over size in radius can be determined by measuring, along a line perpendicular to the axis of the hob, the distance between the outside of the conventional hob and the intersection of the line of action with the root circle of the spline.

Let R_r = root radius of spline;
H = lead angle of hob;
R_h = radius of form of outside of hob.
Then,

$$R_h = \frac{R_r}{\cos^2 H}$$

The outside of the hob blank would be turned to form. The roughing out of the thread and the cutting of the gashes, and also the relief of the sides of the hob teeth, would be done in the usual manner. The relief of the cylindrical portion of the outside of the hob would also be done in the usual way. In addition, the curved section of the outside of the hob would be relieved by a form tool, and this relief would be done without any lead, or movement in an axial direction.

A hob of this type could also be made to cut grinding clearance at the root of the spline, as shown in Fig. 5. In this case, the relieving tool for the sides of the hob teeth would be made to relieve the tops also. The relief of the outside of the central part of the hob would then be obtained as before.

* * *

Canadian Machinery Trade in 1934

A report on the Canadian Machinery Trade in 1934, prepared by Assistant Trade Commissioner Avery P. Peterson, Ottawa, Canada, for the Bureau of Foreign and Domestic Commerce, Washington, D. C., has been published by the Bureau. The report is unusually comprehensive, giving complete details and statistics pertaining to the Canadian machinery trade. It can be obtained from the Machinery Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., at 10 cents a copy.

Calculations for Hob Tooth Form for S A E 1 1/2-Inch Ten-Spline Shaft

E	3°	6°	9°	12°	15°	18°	21°	24°
D	78° 10′ 48″	75° 10′ 48″	72° 10′ 48″	69″ 10′ 48″	66° 10′ 48″	63° 10′ 48″	60° 10′ 48″	57° 10′ 48″
Cos D	0.20484	0.25550	0.30603	0.35548	0.40386	0.45119	0.49728	0.54200
Sin D	0.97879	0.96681	0.95200	0.93468	0.91482	0.89243	0.86759	0.84038
R cos D	0 15363	0.19163	0.22952	0.26661	0.30290	0.33839	0.37296	0.40650
R cos $D - A$	0.03863	0.07663	0.11452	0.15161	0.18790	0.22339	0.25796	0.29150
y	0.00791	0.01958	0.03505	0.05389	0.07589	0.10079	0.12828	0.15799
X	0.03781	0.07408	0.10902	0.14171	0.17189	0.19936	0.22380	0.24497
Arc E	0.05236	0.10472	0.15708	0.20944	0.26180	0.31416	0.36652	0.41888
R arc E	0.03927	0.07854	0.11781	0.15708	0.19635	0.23562	0.27489	0.31416
x	0.00146	0.00446	0.00879	0.01537	0.02446	0.03626	0.05109	0.06919

Finishing Zinc and Aluminum Die-Castings

Die-Castings May be Used as They Come from the Casting Machine or They May be Provided with Various Finishes. Lacquering, Enameling, Japanning, Varnishing, and Plating are the Processes Commonly Used. First of Two Articles

By HERBERT CHASE

Electric Fan Bases, Die-cast from Zinc Alloy, are Usually Finished in Synthetic Enamel, Available in Black and in a Wide Range of Colors

MANY zinc and aluminum die-castings are used without any additional finish, as the alloys of both metals are quite resistant to corrosion, except for surface discoloration, under usual conditions of exposure. Aluminum die-castings are often buffed or burnished and used without plating or other finish, as they hold this polish for quite long periods, especially in indoor exposure. This is largely because the oxide film that forms immediately when aluminum is exposed to the air is transparent and protects the metal against further corrosion.

Zinc die-casting alloys also take a high polish readily, but they tarnish and discolor quickly unless given a protective coating. In outdoor exposure, oxides dull the surface of either zinc or aluminum. Such tarnishing or corrosion is not usually harmful, except as to appearance, since the oxides protect the metal. Under ordinary conditions, the oxidation is confined to the surface and does not affect the interior portions, provided, in the case of the zinc alloys, that they are properly made in accordance with A.S.T.M. specifications.

When either zinc or aluminum die-castings are exposed to view and used under conditions in which a protective or ornamental finish is desirable, they are usually given a chemical, electro-chemical, lacquer, or oleo-resinous finish. Such finishes are the same as or very similar to those used on other metallic products, but certain important precautions must be followed to secure adherent and otherwise satisfactory coats. Since the cost of coating often equals and sometimes exceeds the cost of the castings themselves, there is good reason for following proper methods and using the right materials, especially as the finish often has much to do with the sale and satisfactory service of the product.

In general, first cost is an important factor in the selection of a finish. Unfortunately, there is no fixed rule governing the relative cost of various types of finish, because the number of variables involved is very great. Some general observations in this regard may be made, however, with the understanding that there are many exceptions.

Certain chemical or electro-chemical dips give about the cheapest finish, but such finishes are usually limited as to color. Next in order of cost are likely to be the organic finishes, including lacquers, which dry by evaporation of the solvent, and enamels, japans, and varnishes, which dry by oxidation. As a rule, and for substantially equal appearance of coating, lacquers are more expensive than the oxidizing oil finishes, even if these materials sell for about the same price per gallon. This is because lacquers have much less covering power and generally require rather expensive reducers. Two or more coats of lacquer are likely to be required also, to approximate the results secured by a single coat of good synthetic enamel. Better adhesion and better resistance to deteriorating factors are usually also obtained with good synthetic enamels, especially when baked, as well as with japans, which require baking.

Hence, as a rule, lacquers are used on die-castings in preference to oxidizing oil finishes only when baking equipment is not available. Even when lacquers are selected, forced drying is likely

to give quicker and better results than air drying. Japans, available only in black, make an excellent finish for die-castings, particularly if applied in more than one coat over a suitable primer. Such practice, in general, makes them more expensive than good synthetic enamels, especially when a single coat of the latter is satisfactory, and demands baking at a higher temperature. Japans for baking at about 300 degrees F., which is the maximum temperature recommended for zinc die-castings, are available; but japans for baking at 350 to 450 degrees F. are recommended, and are quite satisfactory on aluminum alloys.

As a rule, electroplating costs somewhat more than coating with an organic finish, though the number of coats of the latter required, and the thickness and character of the plated coating used, may alter the relative cost materially. Plating, of course, is usually preceded by polishing or buffing, or both, and frequently requires buffing and coloring after plating, to secure the required luster. A scratch-brush finish is sometimes used before plating, and in this case, no polishing is required after plating. This may be cheaper than a buffed finish. Unless automatic buffing equipment is warranted, as is seldom the case, except when very large quantities are to be buffed, buffing operations require considerable hand work and add materially to the cost of plating.

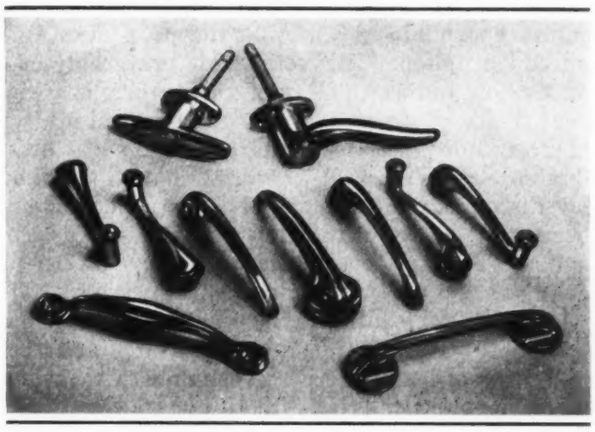
Another factor that has an important effect on the cost of plating is the character and thickness of plate required. The enduring qualities of plated coatings are generally in direct proportion to their thickness. For good resistance to outdoor exposure, nickel coats (which are generally recommended as the base coat for both zinc and aluminum castings) should be at least 0.0003 inch thick, and from 0.0005 to 0.001 inch is often recommended on high-grade work. All plated coatings are porous, but a thick coat helps materially to reduce the porosity. About 0.0002 inch of nickel is often satisfactory for zinc parts used indoors, and even thinner coats are sometimes used on very cheap products.

Flash coats of chromium are frequently applied over nickel on both zinc and aluminum. They add little, if anything, to the protection of the base metal, but prevent tarnishing of the nickel and give a bright finish of bluish cast, whereas nickel has a yellow tinge.

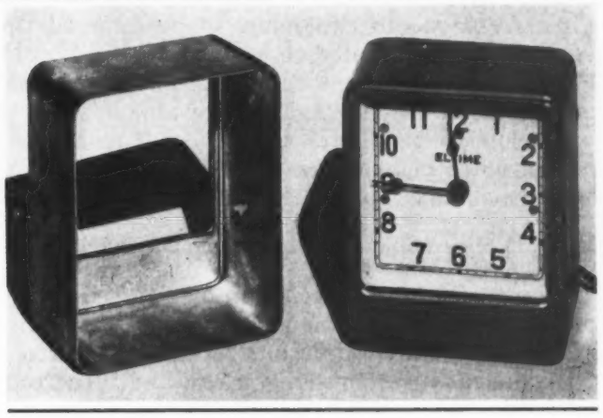
The following prices, quoted by one representative plater on finishing small shallow cup-shaped zinc-alloy die-castings measuring about 1 1/4 inches in diameter by 1/2 inch deep, in large quantities, give an idea of the relative costs of certain types of finishing on a very inexpensive part. Naturally, the relative costs are likely to be different on other shapes and sizes of castings, and will vary also with the quality or thickness of the coat. (Prices are per thousand pieces):

1. Clear, high-grade lacquer over either buffed or scratch-brushed zinc (no plating included), $11.
2. Scratch-brush and nickel-plate, without subsequent buffing, $13.75.
3. Buff, nickel-plate, and buff after plating, $16.50.
4. Scratch-brush, nickel-plate, and flash chrome-plate, without subsequent buffing, $19.25.
5. Buff, nickel-plate, flash chrome-plate, and buff, $22.

Scratch-brushing is sometimes done in preference to buffing to give a satin-like finish, which does not, of course, have the high polish of a buffed piece. Such brushing can be done on a smooth surface that can also be buffed, if preferred; but it is also done on many castings of such irregular shape



Automobile Hardware — Plated Zinc Die-castings. A Heavy Coat of Nickel with a Flash of Chromium Gives Excellent Results. Some Platers Prefer a Heavy Coat of Copper, Followed by an Equally Thick Coat of Nickel and a Light Coat of Chromium



Clock Base or Frame Die-cast from Zinc Alloy 0.035 Inch Thick. This Case Replaced a Drawn Case that had a Tendency to Show Ripples and Draw Marks, and that became Distorted when Polished. Die-casting Overcame these Difficulties and Cost Less

that buffing is not practicable, as it is difficult to buff into recesses. With scratch-brushing, no buffing or coloring is required after plating.

Although barrel-plating of small, inexpensive zinc parts has been done to a limited extent, the process is not yet developed commercially except, perhaps, in a few scattered plating shops. There is promise that it may be developed for general use in the future.

Ball-Burnishing in Tumbling Barrels

Many aluminum die-castings of small size, and some quite large ones, are ball-burnished in quantity in tumbling barrels. Although the finish thus applied is not equal to that produced by buffing, the luster is sufficient for many inexpensive articles. The method is much less expensive than any process in which each article must be buffed individually, except in cases where automatic polishing of very simple parts is practicable.

In ball-burnishing, the barrel is about half filled with steel balls, 1/4 inch in diameter, and the remaining space in the barrel is nearly filled by the castings, after which both are covered with a solution made by dissolving Ivory burnishing soap in *soft* water, in the proportion of 2 ounces of soap to each gallon of water. Burnishing generally requires from one to two hours, depending on the degree of luster wanted, but since no hand work is required, except in loading the barrel, the expense is small. Ball-burnishing of zinc has yet to be developed commercially. This method has not been in much demand, as burnished zinc die-castings tarnish unless protected by lacquer or varnish.

Preparation for Applying Finishes

Prior to the application of any surface finish, whether of the oleo-resinous type or electroplating, it is essential for good results to have the surface of the die-casting thoroughly clean and free from any foreign matter. Castings to be plated are usually buffed or scratch-brushed. They occasionally require some polishing prior to these operations, although with good die work and good casting practice, the surface is so smooth that polishing is seldom required, except, perhaps, where the fin and gate have been sheared or filed off. In polishing, emery of about 180 mesh is usually employed for zinc castings, and about 150 in the case of aluminum. Fine polishing is sometimes done with 240-mesh emery for zinc and 180 for aluminum. The latter operation is also termed "oiling."

Buffing is done with tripoli on cloth or canvas wheels running at 5000 to 7000 feet per minute surface speed, and may be followed by a final buffing which is termed "coloring." It is better to avoid the use of lime in coloring, because it is likely to form insoluble precipitates during subsequent cleaning, which is necessary before plating. This cleaning is required to remove any grease and other foreign matter which remains after the polishing and buffing.

Cleaning Preparatory to Plating Die-Castings

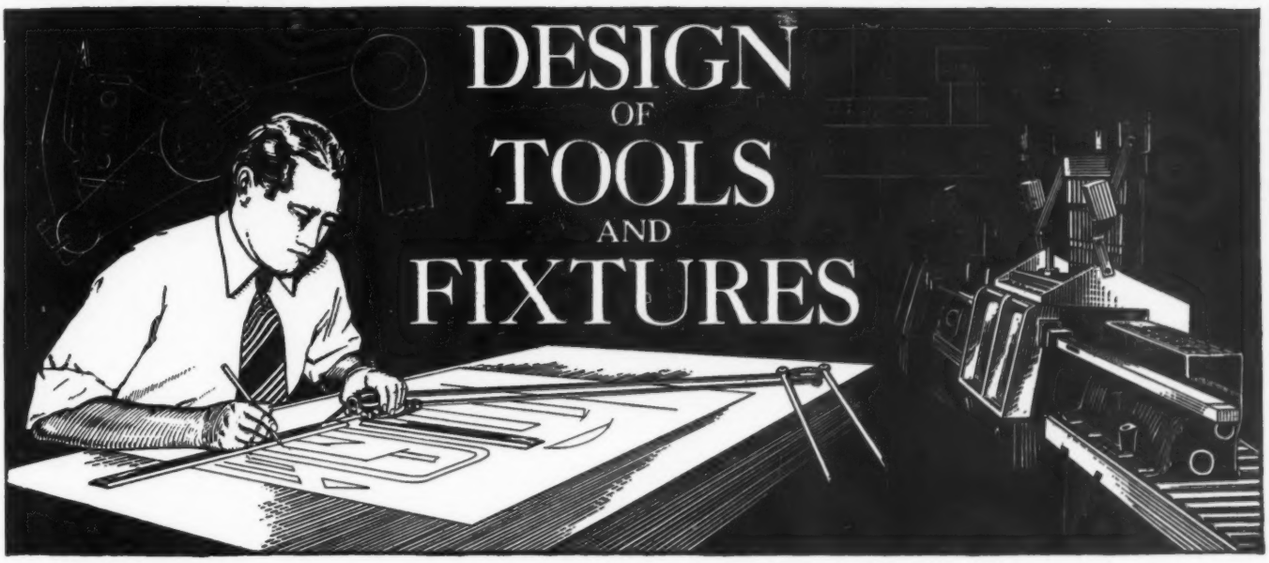
Solvent cleaners are often used and are excellent for removing grease, but are likely to leave a thin film of grease dissolved by the cleaner, unless a modern degreasing machine, in which the solvent is condensed on the castings to be cleaned, is employed. Before plating, and often before the application of organic finishes, a chemical cleaner should follow the use of a solvent cleaner. Chemical cleaners react with foreign matter on the surface and are often used most effectively as electrolytic cleaners with the casting as the cathode, owing to the fact that the gases generated tend to loosen foreign matter which might otherwise adhere.

There are many prepared platers' alkaline cleaners that are effective, and they should be used as directed by the manufacturers. An effective solution for zinc castings is made by dissolving trisodium phosphate in water in the proportion of 6 ounces per gallon. This solution is preferably used boiling hot, and as an electrolytic cleaner, in which event a dip of from one-half to three minutes is generally adequate. Whether this or some other alkaline cleaner is used, the dip should not noticeably discolor zinc castings. The treatment should never extend beyond the time required for a thorough cleaning, as over-cleaning may bring about peeling of the plate later applied.

After this cleaning, zinc castings should be thoroughly rinsed in hot and cold water and then dipped for one minute in a fresh cold bath, which may contain either from 5 to 10 per cent of hydrochloric acid or 1 per cent of hydrofluoric acid. This neutralizes any remaining cleaner and dissolves any zinc salts. It also etches the metal slightly, which helps to improve the adherence of subsequent plate, though excessive etching may have the reverse effect. After this dip, there should be a thorough rinsing, and plating should follow this rinsing immediately.

The solvent cleaning method for aluminum castings is the same as for zinc, but different solutions are used for chemical cleaning and etching. The alkaline cleaner often recommended contains 1 ounce each of trisodium phosphate and sodium carbonate per gallon of water. This cleaner is used hot for dips of about thirty seconds which produce gassing that is helpful in the cleaning action. A thorough rinsing should follow this bath, and the castings should then be etched by dipping, for from fifteen to thirty seconds only, in a solution containing three parts of concentrated nitric acid to one part of 50 per cent hydrofluoric acid. After etching and rinsing, the casting is ready for plating. Etching under-cuts the network of alloying elements which are attacked selectively, and thus forms keys, which are of great importance in promoting adherence of the plate.

In a coming number of MACHINERY, the actual plating, lacquering, enameling, and japanning processes will be dealt with.

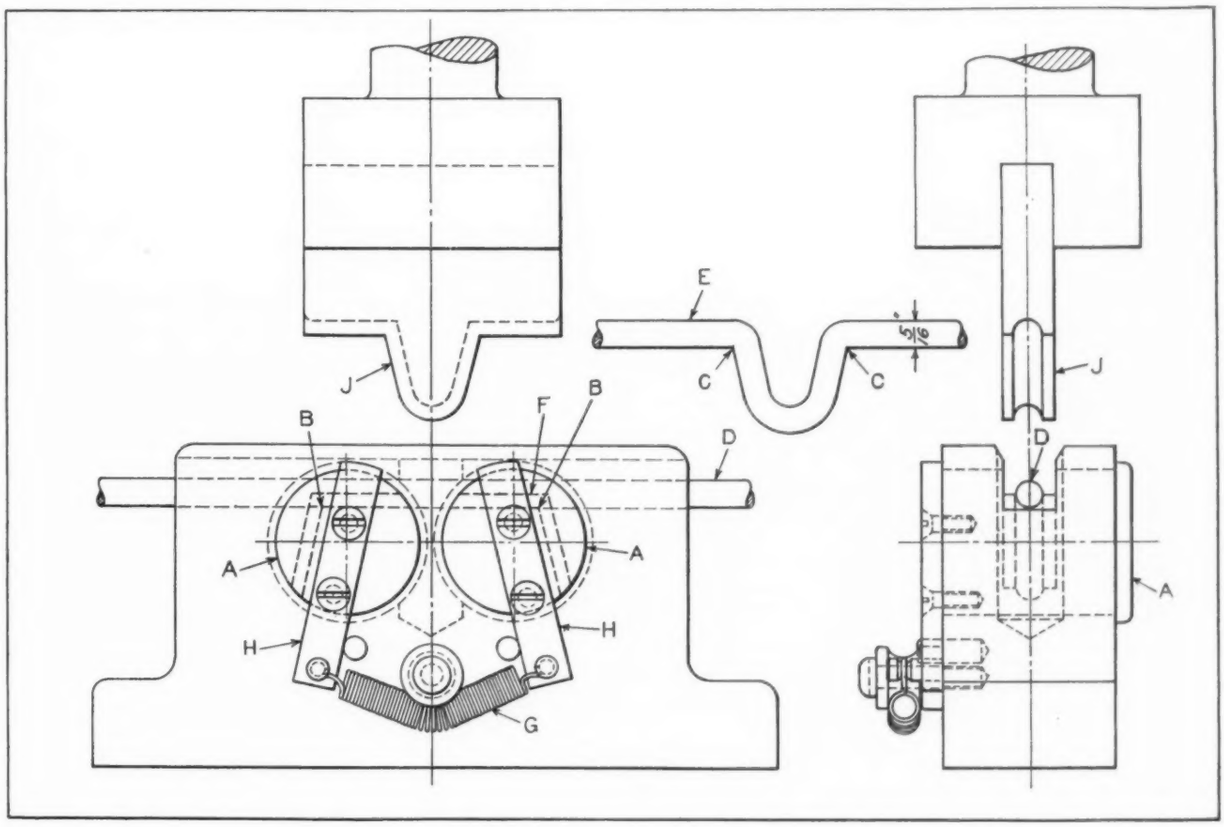


Die for Making a U-Shaped Bend in Round Stock

By VICTOR ARKIN, Los Angeles, Cal.

The principal requirements in producing the part shown at *E* in the accompanying illustration are that the corners at *C* be kept sharp and that the U-shaped bend be made in one operation. The main feature of the die shown, which was designed to fulfill these requirements, is the use of the rollers *A*. These rollers are grooved at *F* to conform to the shape of the finished part, so that points *B* are situated at just the right distance apart when the bending operation begins.

The bending punch *J* is also grooved to fit the work. When the punch descends and begins to bend the wire rod *D*, the rollers *A* turn inward so



Bending Die for Making U-shaped Bend in Part E in One Operation

that, upon the completion of the downward stroke, the corners or points *B* form the sharp corners on the work at *C*. The spring *G* attached to levers *H* serves to bring the rollers back to their original positions.

Indexing Fixture for Machining Compressor Ports

By CHARLES C. TOMNEY, Chief Tool Designer, Carrier Engineering Corporation, Newark, N. J.

The indexing fixture shown in Fig. 1 is used on a radial drill for drilling, tapping, facing, and grooving the suction and discharge ports *B* and *A*, Fig. 2, in the cylinder blocks of 5-inch by 3 1/2-inch compressors. The two cylinders of the compressor are cast in one block which is located in the fixture shown in Fig. 1 by the two horizontal mandrels *M* and *N*, which fit the cylinder bores. There are two ports on each side of the cylinder block like the ones shown at *A* and *B*, Fig. 2.

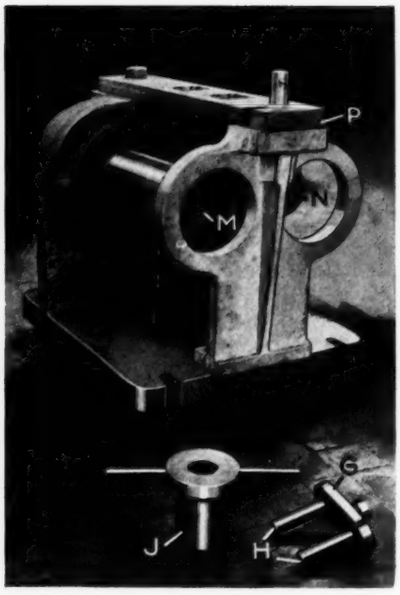


Fig. 1. Fixture and Drill Bushings Used in Drilling, Tapping, and Facing, Ports A and B, Fig. 2

The bushing plate *P* is the feature of special interest. This plate is designed for use in drilling and tapping the four stud holes and in facing and grooving the ports without removing the plate. Referring to Fig. 2, it will be seen that the diameter of the faced surface of each port is 3 1/8 inches and that the stud holes are drilled on 3 3/4-inch centers. The inside edges of the tapped holes are flush with the edge of the faced surface. The facing tool is made at least 3 1/2 inches in diameter in order to allow for irregular castings. If four drill bushings were put in the plate in the usual way and one large bushing were used in the center for the facing tool pilot, it would be necessary to remove the plate in order to perform the facing and grooving operations.

It will be noted that there are two sets of holes at *C* and *D* in the bushing plate. The hole *D* is for the discharge port *A* and the hole *C* is for the suction port *B*. In making the bushing plate, four holes *E* are bored in the usual way to receive the drill bushings. After the four smaller holes are bored, the large hole *F*, which is 3 1/2 inches in diameter, is bored. This results in cutting away about half the metal around the bushing holes *E*,

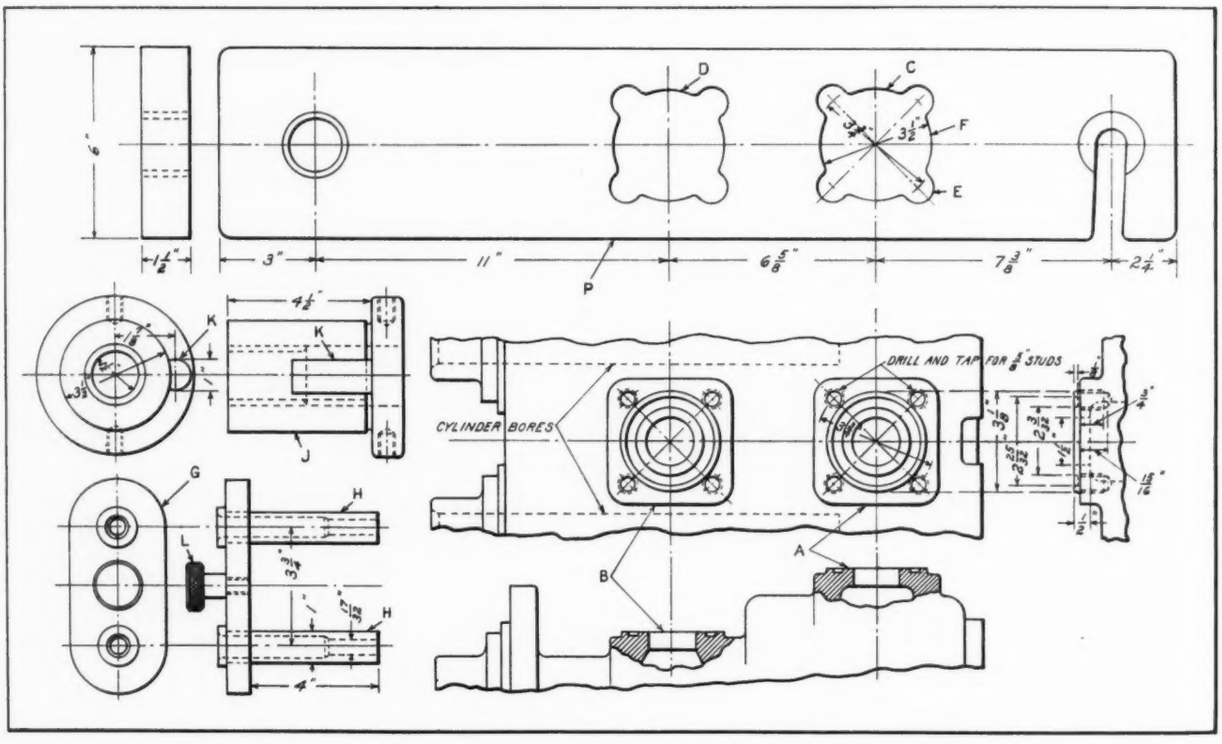


Fig. 2. Bushing Plate P and Drill Bushings J and H Used in Machining Ports in Compressor Cylinder Blocks

but sufficient metal remains for locating purposes. In order to hold the drill bushings in place while drilling the holes for the 5/8-inch cap-screws, a special bushing-holder *G* is used. This is bored to receive the long drill bushings *H*, which have the same center-to-center spacing as holes *E* in plate *P*.

The machining operations on the ports are as follows: The cylinder block is placed in the jig and the larger bushing *J* is inserted in the 3 1/2-inch hole *F* for drilling the 1 1/2-inch hole in the center of the port. This hole is then used for piloting the facing and grooving tools. A lug *K* is fastened underneath the head of bushing *J* to prevent it from turning in hole *F*.

The bushing plate *G* is inserted diagonally in the larger plate *P* and two holes are drilled for the 5/8-inch tap. Holder *G* is then removed by means of the handle *L*. The remaining two holes are drilled in the same way. The holes are then tapped, after which the fixture is indexed and the operations repeated on the ports in the other side of the cylinder block. While this method does not produce extremely accurate work, it is sufficiently accurate for the job described. Of course, the holder *G* could be made with four bushings instead of two, if desired.

Die for Piercing Ten Slots in Wall of Drawn Shell

By HENRY W. BOEHLY, Howard Beach, L. I.

The piece shown at *A*, Fig. 1, is a cuplike drawn shell in which ten slots, in two groups of five slots each, are pierced as shown. These slots are required to be located accurately with respect to other holes in the part, and the two groups of holes must be symmetrical.

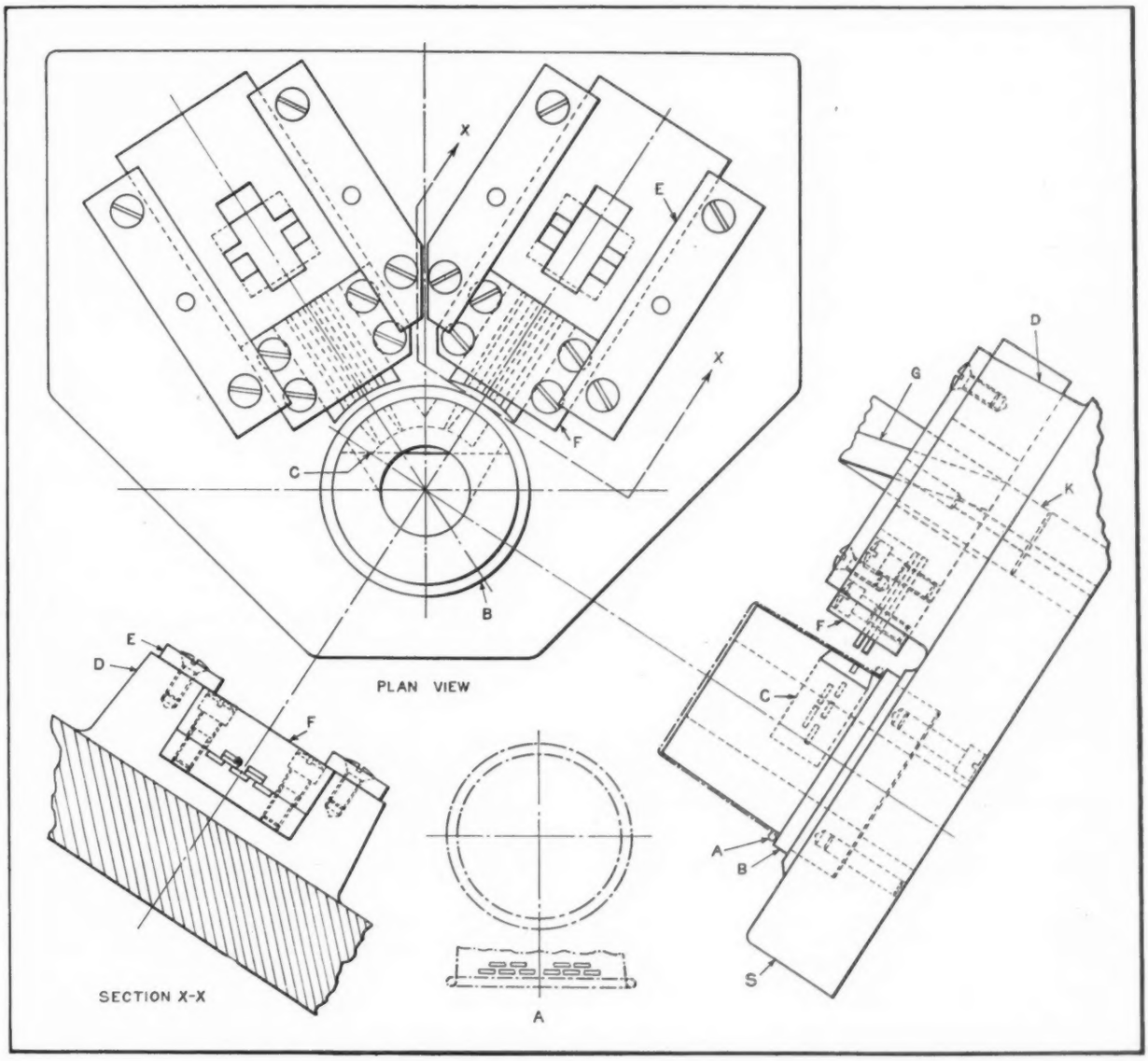


Fig. 1. Die for Piercing the Ten Oblong Slots Shown in the Head Casing A of a Small Vehicle Lamp

At first a die was used that pierced one group of holes at a time. This, however, proved unsatisfactory, and after a study of the problem, the special die shown in the accompanying illustration was constructed. The main base *S*, Fig. 1, is of cast iron. The part *B* is accurately fitted in base *S* and is locked in place by means of dowels and fillister-head screws. The external shape of part *B* is formed to fit the drawn piece *A* very closely.

The piercing die member *C* is fitted into part *B* by means of a dovetail as shown. This, of course, greatly facilitated the machining of the die slots and assured accurate positioning of the slots with respect to each other. The punch guides *D*, which are an integral part of the base, are machined to an accurate finish for guiding the built-up punch-holder, shown at *F*, Fig. 2. The angular positions of the guides *D*, Fig. 1, permit the two punch-holders *F* to move inward radially. The punch-holders are held in place by the retaining plates *E*.

The punches proper are of simple rectangular shape and are fitted into the slots provided for them in the punch-holder *F*, in which they are clamped. Other locking devices are used sometimes to hold the individual punches. However, in the case of the punch shown, no additional locking means is required. The horizontal motion is imparted to the punches by the bars *G*, Fig. 2.

The fundamental operating principle of the tool as a whole is indicated by the views in the lower right-hand corner of Fig. 2. When the bars *G* move down vertically with the ram a distance *Y* as shown, the punches move outward in a horizontal direction a distance *X*, as indicated, through the action of the angular lips on the sides of bars *G*. Angular slots *T* are cut in the punch-holder at the sides of the rectangular openings which are cut through the punch-holder. The views in the upper right-hand corner of Fig. 2 show one punch-holder without the punches. These views show the type of angular slots which fit the angular lips on the bars *G*. The backward thrust of the bars *G* when the ram descends is taken by the square hole *K*, Fig. 1, in the base of the die.

The punch-holders are casehardened and ground. Bars *G* are also hardened at their lower ends. They are of sufficient length to prevent interference with the operation of the tool when inserting the work in the die. The bars *G* are attached to the ram by means of the bar holder, as illustrated at *H*, Fig. 2. A greater number of punch guides could, of course, be used with a die of this design.

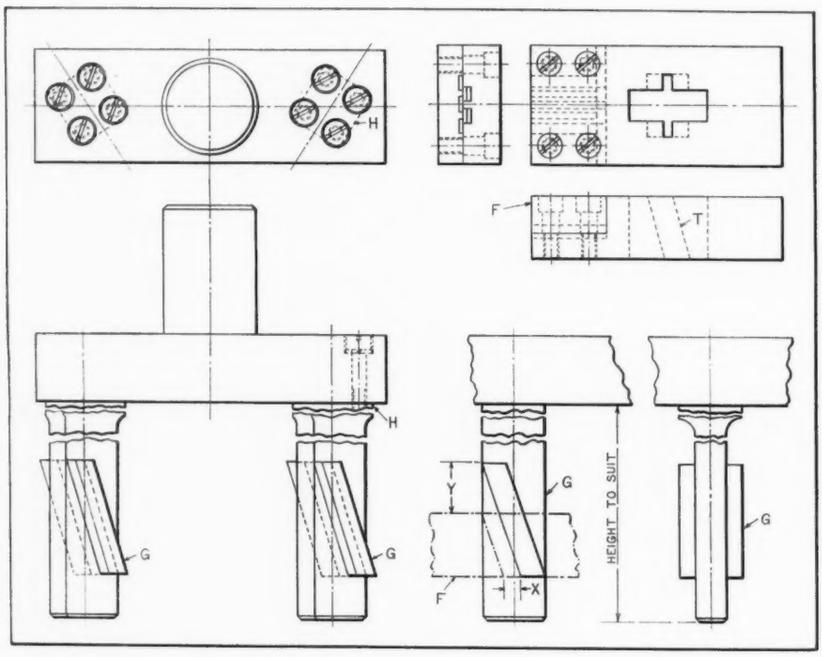


Fig. 2. Member Mounted on Press Ram for Actuating Horizontal Slide F of Die Shown in Fig. 1

* * *

Bonderizing Process Installed by Buick Motor Co.

A new rustproofing process, said to represent a considerable advance in the protection of metal parts against corrosion and the action of the elements, has been installed and is now in operation at the plant of the Buick Motor Co., Flint, Mich., as part of the $14,500,000 modernization and expansion program being carried on by the company. The new method has been developed by the Parker Rustproof Co., Detroit, Mich. It employs a spray rather than an immersion. With it, all stamped metal parts of the cars, including the coil springs for the knee action, are protected, prior to lacquering or enameling, against rust.

The process is a further development of the basic bonderizing system which consists of giving metal parts a phosphate crystalline coating that not only prevents corrosion under the finish, but also prevents the spread of corrosion from accidental scratches which penetrate to the bare metal. Further, it is said to provide a better adhesive base for the application of the finishes themselves.

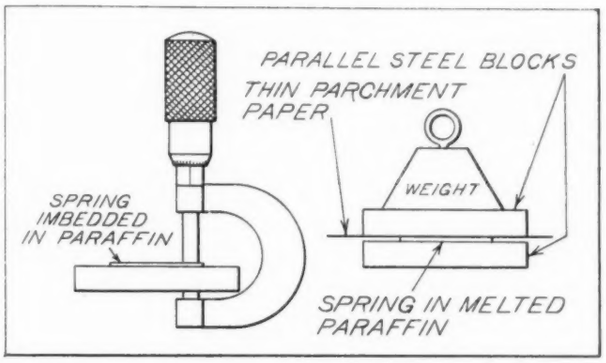
The entire process, from the cleaning through the bonderizing, fixing, and drying, is automatic, the parts being carried by two continuous conveyors. There are eight steps in the entire process that prepare the metal parts for the application of the final finish, including the passing of the material through six pressure spray booths. There are almost 1000 nozzles in the spray booth supplied under pressure by two pumps operating at 1000 gallons per minute.

Ideas for the Shop and Drafting-Room

Time- and Labor-Saving Devices and Methods that Have been Found Useful by Men Engaged in Machine Design and Shop Work

A Delicate Lapping Operation

The article in February MACHINERY, page 353, describing the production of microscopic laps called to mind a lapping job presented to the writer for



Methods Employed in Removing 0.0015 Inch from Sides of Spiral Spring Used in a Super-sensitive Electrical Instrument

solution some time ago. A small spiral spring similar to the hair-spring in a watch was required to be reduced in cross-section. The reduction in cross-sectional area was to be made by removing stock from the edges of the spring without changing the general shape of the spiral.

Although the job at first appeared to be a rather difficult one, it was handled successfully in the following manner: The surfaces of two steel blocks were first ground plane and parallel. The spiral spring was then placed on one block, and both blocks and the spring were slowly warmed by placing them in a small oven. Melted paraffin was next poured over the spring, and a piece of thin parchment paper laid over the paraffin. Then the second block was laid on the paper, and the pieces thus assembled were allowed to cool.

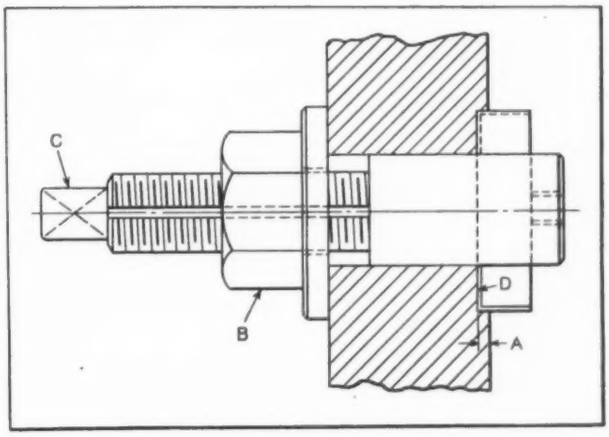
The top block was now removed and the paper peeled off. One side of the free block was charged with "400" emery and used as a lap. The paraffin was very gently wiped away from the top edge of the spring with a piece of cotton cloth, and the lap tried until a cutting action could be felt. The width of the spring was held uniform by measuring with a micrometer, as shown in the accompanying illustration. After about half the amount of stock to be removed had been cut away by the lap, the spring was detached from the block by placing the block in hot benzine. The spring was then remounted and the removal of stock continued on the other side in the same manner until the width of the spring had been cut down 0.0015 inch. The shape of the spiral and the mechanical properties of the spring remained unchanged.

Rapids City, Ill. LEWIS N. STEWART

Hand-Operated Counterboring Tool

In overhauling certain machines, it is often necessary to reface the surfaces around holes that are inaccessible to tools ordinarily used for such operations. The hand-operated counterboring tool illustrated was made for such cases.

This tool consists simply of an arbor, cutter, washer, and feeding nut *B*. The end of the arbor carrying the cutter is a close turning fit in the hole to be counterbored and the threaded end has a keyway in it. The snug fitting washer has a key or



Hand-operated Counterboring Tool for Use in Inaccessible Places

tongue which is a sliding fit in the keyway and prevents the washer from turning on the threaded portion of the arbor. The illustration shows the work counterbored at *D* to a depth *A*. The cutter is fed into the work by tightening the nut *B*, and is turned by means of a wrench applied to the squared end *C*. This is not a new idea, but many mechanics are not familiar with it.

Long Island City, N. Y. EDWARD A. HEALEY

Questions and Answers

A Department in which the Readers of MACHINERY are Given an Opportunity to Exchange Information on Questions Pertaining to the Machine Industries

L. M. S.—What material should I use for coil springs that will retain their springiness and resist corrosion better than spring brass or phosphor-bronze, when used in corrosive atmospheres at temperatures from 200 to 250 degrees F.?

A.—In a brief article by Warren F. Manthei in September, 1932, MACHINERY, page 24, it was stated that: "Springs made of Monel metal have recently proved their ability to operate in hot corrosive atmospheres. Their tensile and torsional strength and endurance lie between those of phosphor-bronze and steel. Monel metal is also free from the 'season cracking' phenomenon found in spring brass. Among other uses, springs made from this material are suitable for surgical instruments that have to be sterilized in hot solutions."

Machinery Sold on Installment Plan Erected in a Mortgaged Building

G. E. D.—I understand that a seller of machinery on the installment plan cannot repossess it if it is installed in a mortgaged building. Is this true?

Answered by Leo T. Parker, Attorney-at-Law
Cincinnati, Ohio

Contrary to the opinion of many people, a party who has a valid mortgage on a building automatically takes legal title to any machinery that subsequently may be installed in the building by the owner of the building who purchases and installs the machinery without the knowledge of the holder of the mortgage. This holds true even though the purchaser of the machinery should enter into a contract with the seller by the terms of which the latter is privileged to repossess the machinery in the event the purchaser fails to fulfill his contract in making payments at the time specified.

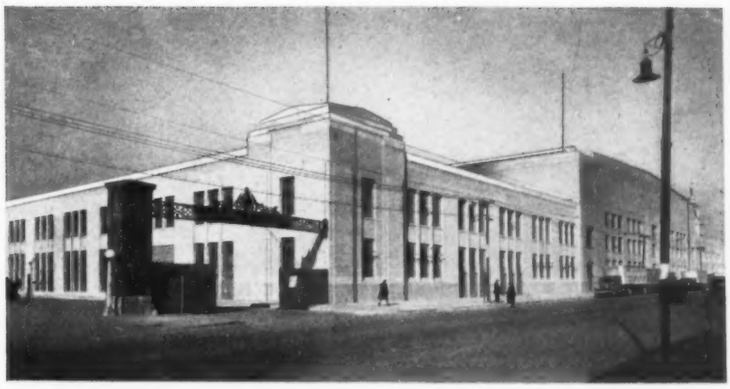
The latest higher court case involving this point of the law is Central Co. [175 Atl. 701]. In this case, the owner of a building mortgaged it, and the holder of the mortgage properly recorded the mortgage. Some time later, the owner of the building purchased some machinery on the installment plan under a contract which specified that if the purchaser failed to pay for the machinery in accordance with the terms of the contract, the seller had the privilege of repossessing the machinery.

The purchaser of the machinery who, as mentioned, was also the owner of the building, failed to pay for the machinery in accordance with the contract. The seller attempted to gain possession of the machinery. The holder of the mortgage on the building had received no information that the owner of the building had purchased the machinery. The owner of the building himself, knowing the legal point involved, contested the right of the seller to remove the machinery or otherwise take possession of it.

In this case, the Court held that, under the circumstances, the seller of the machinery had no right to remove it. The Court said: "The machinery and equipment are quite heavy and occupy considerable space. Some of it is bolted to concrete foundations and grouted in; some is otherwise attached to the foundations. . . . The removal of the machinery and equipment might not cause great physical damage to the building as a building, but would result in material and irreparable injury to the plant as a manufacturing establishment. . . . We do not regard as solely controlling the damage which would be done by the removal of the machinery as that suffered by the building alone, but the damage that would ensue to the plant as a plant."

In order that the seller of machinery shall be safeguarded against the owner of a mortgaged building, or the party holding the mortgage, claiming title to machinery installed in the building, it is advisable that the contract between the buyer of the machinery and the seller shall clearly specify that even though the building be mortgaged, the seller has a right to repossess the machinery installed if the purchaser does not fulfill the terms of the sales contract. The contract should further contain a clause in which the purchaser (the owner of the building) agrees to notify the holder of the mortgage and obtain his consent to install the new machinery in accordance with the agreement between the buyer and the seller.

It is advisable that the seller properly record all contracts by the terms of which the machinery is sold on the installment plan. Any person who sells machinery to be installed in a mortgaged building should examine the county records to determine whether the building is mortgaged; and if he discovers that it is mortgaged, he should proceed as outlined. He should, in all instances, also gain consent of the owner of the mortgage to install the machinery on the terms of the sales contract.



The Seventeenth Annual National Metal Exposition

CHICAGO, SEPTEMBER 30-OCTOBER 4

THE seventeenth annual National Metal Exposition, held under the auspices of the American Society for Metals, opens its doors at the International Amphitheater, 43rd and Halsted Sts., Chicago, Ill., just as October MACHINERY goes into the mails. The exposition opens Monday, September 30, and will remain open until and including October 4.

The new Chicago International Amphitheater, built in 1934 at a cost of over $2,000,000, provides an imposing setting for what is the largest Metal and Materials Exposition held in the last five years. The two hundred and five exhibits here congregated will afford plant executives, superintendents, metallurgists, and engineers a most unusual opportunity to study and compare new products, processes, and materials, many of which are displayed to the mechanical public for the first time.

The exhibition, which has become an annual institution in the metal industries, includes not only iron, steel, and non-ferrous metals, but also materials of every kind, including the newly developed synthetic plastics. Recent equipment brought out by industry for welding, cutting, heat-treating, inspecting, and testing metals are also shown. Shop equipment, cutting and lubricating oils, precision tools and instruments, refractories, abrasives and rustproofing compounds complete the exhibits.

An added value of the exposition is that many of the exhibits are in operation, and some remarkable working models are shown.

As has been the custom in past years, the National Metal Exposition is held in conjunction with a National Metal Congress, in which several societies cooperate, including the American Society for Metals; the American Welding Society; the American Institute of Mining and Metallurgical Engineers, of which the Institute of Metals and the Iron and Steel Divisions will hold meetings; and the Wire Association.

A Preview of Some Exhibits at the National Metal Show

IT is not possible in a brief review to make mention of all the exhibits at the Metal Show. The object of the following paragraphs is merely to call attention to a few of the exhibits displaying either recently brought out equipment or newly developed materials. New materials and equipment not included in this article will be referred to in coming numbers of MACHINERY.

The new motor-driven precision milling machine, known as MD-5, recently brought out by Hardinge Bros., Inc., Elmira, N. Y., will be exhibited by this company in conjunction with other equipment, including a new enclosed-head bench lathe and driving unit. The milling machine, shown in Fig. 1, has an enclosed V-belt drive from the motor in the base, giving six forward and six reverse spindle speeds. The longitudinal travel is 12 inches; the transverse travel, 6 1/2 inches; and the vertical travel, 7 1/2 inches. The centers swing work 6 inches in diameter.

The Leeds & Northrup Co., Philadelphia, Pa., will have at the Show three sections displaying, respectively, triple-control Hump hardening, Homo forced-convection tempering, and Micromax tempering control. All equipment will be in operation. Automatically illuminated cross-section diagrams and an automatically illuminated cross-section of a Homo furnace will clearly illustrate the principles involved.

The Homo tempering furnace, Fig. 2, exhibited by the Leeds & Northrup Co. is especially designed for high capacity on very dense loads. It permits a sharp cut in the cost of fine tempering of very dense loads. This furnace is exhibited for the first time to the mechanical public. It has been thoroughly tested in the field, however, and is now being successfully operated by several heat-treating companies. It operates entirely automatically. The length of soak can be varied; the soak temperature can be raised or lowered quickly; and all loads can be given precisely the same heat-treatment, or each a special treatment.

Actual demonstrations featuring the use of the latest types of arc-welding machines and electrodes will be presented daily at the exhibition by the Lincoln Electric Co., Cleveland, Ohio. The welding

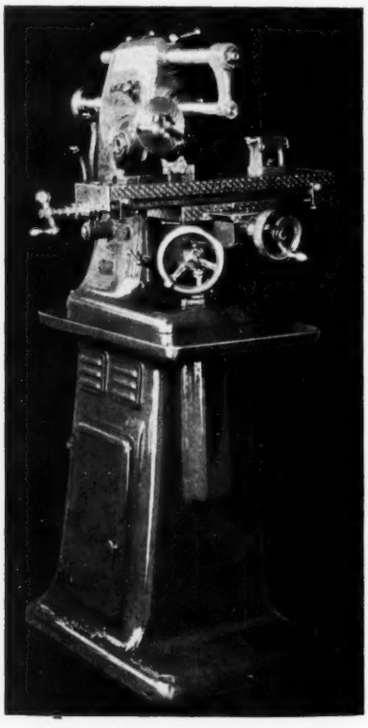


Fig. 1. Hardinge Bros. Precision Milling Machine

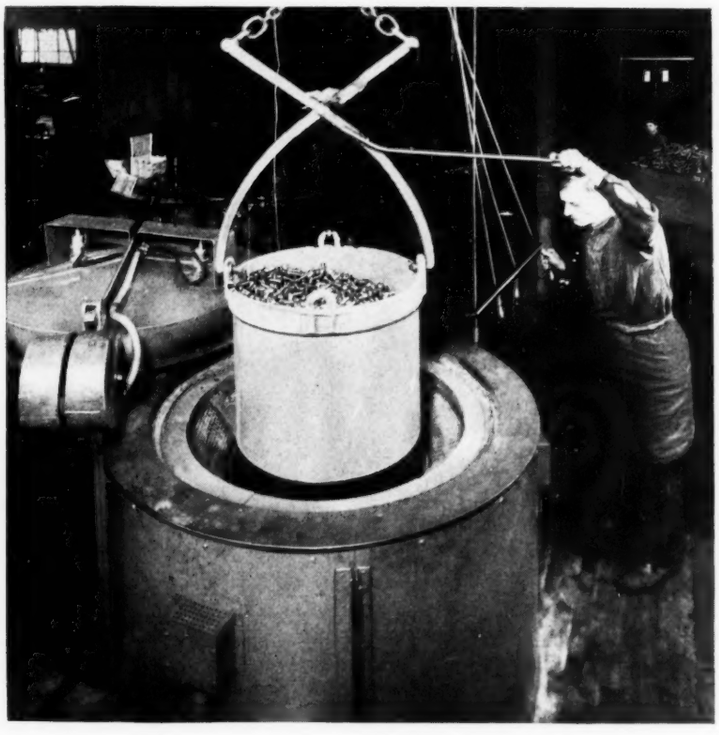


Fig. 2. The Leeds & Northrup Homo Furnace is Shown in Operation at the Show

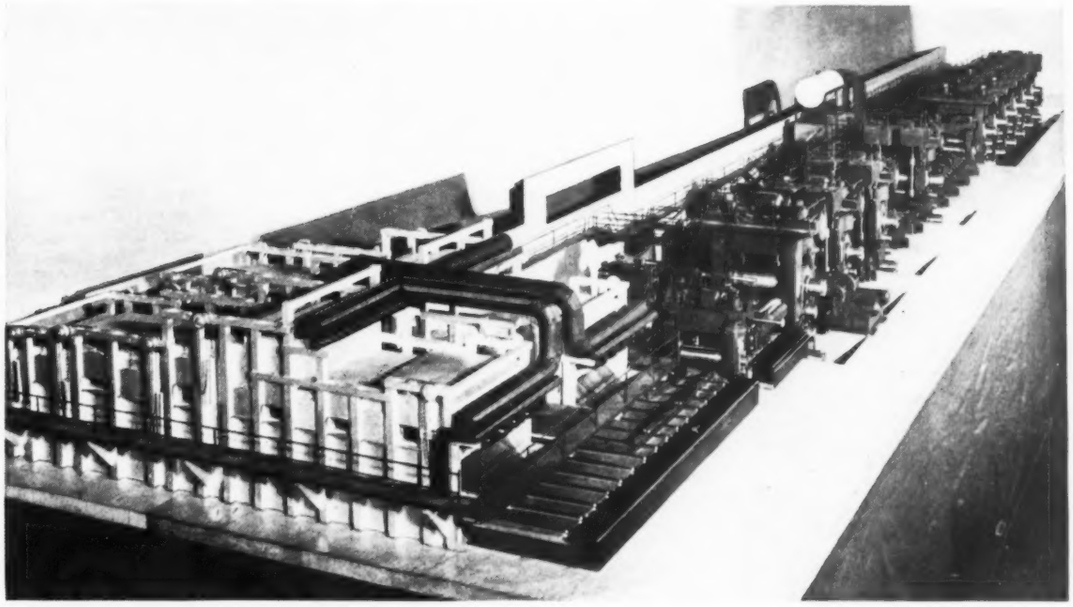


Fig. 3. A 26-foot Long Model of the Youngstown Sheet & Tube Co.'s New Continuous Hot Mill. The Model is so Perfect that it will Actually Roll Tiny Slabs of Metal

of sheet metal will be demonstrated with two new small motor-generator types of arc welders recently placed on the market by the company. These new machines enable the user to weld materials as light as 24 gage, obtaining results of the same quality as is regularly obtained on the heaviest plate with larger machines. The use of two new electrodes—"Toolweld," for applying hard surfaces for cutting edges on cheaper grade shanks, and "Abrasoweld," for building up straight carbon steel, low alloy, or high-manganese steel surfaces to resist severe abrasion—will also be shown.

The Bausch & Lomb Optical Co., Rochester, N. Y., will introduce four new developments in the field of optics that will be of direct interest to the metal industries. These are a new Ortho-Stereo camera and stereoscope, adapted for industrial use; a new electroplaters' microscope; a new grain-size measuring eye-piece; and a new Ampliplan eye-piece for use in photomicrography. The Ortho-Stereo camera is illustrated and described in the Shop Equipment News section of this number of MACHINERY.

The latest development in the use of Perliton liquid carburizer, a comparatively new process of carburizing in liquid salt baths, will be exhibited by E. F. Houghton & Co., Philadelphia, Pa. An actual carburizing bath will be operated and small parts will be carburized to show the effectiveness of the process. Samples of Perlitonized parts ranging from skin hardness to a case 0.040 inch in depth will be on display. A lighted display of Houghton cutting oils and lubricants, and an exhibit of Vim Tred belting and packings will be included.

The Union Drawn Steel Co., Massillon, Ohio, will feature improvements in Bessemer and open-hearth steels. During the past year the company has continued the development first announced in 1934 relating to the improvement in the machining properties of both Bessemer and open-hearth steels, with a view to obtaining longer tool life and correspondingly reduced machining costs. This improvement has been accomplished without altering the chemical and physical properties of the steel.

The central feature of the display of the American Brass Co., Waterbury, Conn., will consist of a welding booth, where C. E. Swift, one of the company's welding engineers, will give a demonstration of gas and electric welding. He will demonstrate the use of the "high-voltage" arc in welding both electrolytic and deoxidized copper, using phosphor-bronze welding rods. He will also do some high-voltage welding on brass and bronze.

A complete line of industrial indicating, recording, and controlling instruments for the metal industry will be exhibited by the Foxboro Co., Foxboro, Mass. Among other instruments that will be shown is a new potentiometer controller with the new Type H drive, an instrument unique in that it has a fixed slide wire contact and knife-edge detection.

The Brown Instrument Co., Philadelphia, Pa., and the Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., will have a joint exhibit featuring new and improved types of recording and automatic control equipment. The exhibit will include the new Brown Air-O-Line controllers for automatically controlled temperature, pressure, flow, or liquid level by means of air-operated

valves. These instruments were described in MACHINERY for September. The Brown Instrument Co. will also exhibit its new Optimatic. This is an automatic recording optical pyrometer capable of recording the temperatures of rapidly moving incandescent bodies such as rails, sheets, bars, or structural shapes while they are being rolled.

In addition, there will be a number of new types of electrically operated valves exhibited by the Minneapolis-Honeywell Regulator Co. One of these, known as the Pilostat, is a rather unique safety pilot valve, operated by the electromotive force generated by a thermocouple placed in the pilot flame. Should the pilot flame fail, the valve will close automatically and it becomes necessary to reset it manually.

The Wright Mfg. Division of the American Chain Co., Inc., Bridgeport, Conn., will exhibit a complete line of hoists and trolleys featuring the company's new improved model spur-geared chain hoist. One of the principal features of the Wright improved hoist is the zinc-coating of all exposed parts, which makes it suitable for outdoor use and for service in moist and corrosive atmospheres.

The Andrew C. Campbell Division of the American Chain Co. will exhibit an abrasive cutting-off machine in actual operation. This new development in cutting-off equipment has previously been thoroughly described in MACHINERY. The unique part is the method used for supplying the cutting disk with a liquid coolant.

Practically the whole of the back wall of the booth of the Timken Steel & Tube Co., Canton, Ohio, will be occupied by a dramatic and colorful presentation of high-quality steel-making, a display that will attract much attention.

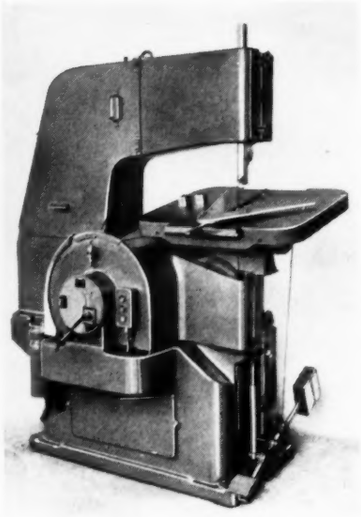


Fig. 4. Grob Bros. Improved Open-end Band Saw

Among its products, the Youngstown Sheet & Tube Co., Youngstown, Ohio, will feature the new alloy "Yoloy," mention of which has previously been made in MACHINERY. This is a nickel-copper alloy steel having exceptional resistance to corrosion and high tensile strength, combined with great ductility, workability, and weldability. This alloy steel is produced in sheets, strips, plates, bars, shapes, wire, and seamless pipe.

Another display of this company that will attract much attention is a model of the company's new continuous hot mill, Fig. 3. This model was made in the pattern and machine shop of the company to a scale of 3/4 inch to the foot. The total length is 26 feet. The model is so perfect that it will actually reduce toy slabs of metal from 1/4 inch to 1/32 inch in thickness. It depicts the entire course of steel through the gigantic machine, lacking only furnace heat and the high-pressure lubricant system employed in the mill.

The open-end band saw shown in Fig. 4 will be exhibited by Grob Bros., West Allis, Wis. This machine follows the design of the company's previously described open-end band saw, but there are several distinct improvements. The table is now equipped with a slide that is connected with a feeding device. The table slide is operated by an adjustable weight which is connected with an oil dashpot, preventing too fast feeding of the workpiece. A limit switch is connected to the feeding device so that the saw band cannot be reversed unless the weight has been taken off. The weight is controlled by a foot-lever. In connection with the table feed, a clamp is introduced that will securely hold any shape of die-block and will allow feeding either straight or along a curved outline.

Carpenter Free-Machining Alloy Steels

PATENTS were granted on July 30, 1935, to Frank R. Palmer and assigned to the Carpenter Steel Co., Reading, Pa., for free-machining alloy steels containing selenium. The utility of selenium as a free-machining element has been established during the past few years through its extensive use in 18-8 chrome-nickel stainless steel. It is now announced that selenium gives promise of successful use in practically all other types of iron and steel products.

Sulphur has been extensively used in low-carbon non-alloy steels for many years, and is quite familiar to the trade under the general name of "screw stock." It is well known that sulphur combines with certain metals in the steel (usually manganese) to form non-metallic sulphides which occur in the form of slag-like stringers in rolled or drawn bars. In high-sulphur steel, the extent of this non-metallic matter is sufficient to discourage its use in high-grade alloy steels, which must be heat-treated and are later subjected to severe service.

It is claimed that selenium is superior to sulphur as a free-machining element in two important particulars: First, a given percentage of selenium does not produce nearly so much slag-like material as an equal percentage of sulphur, so that the cleanness and the uniformity of the product is greatly increased. Secondly, selenium is more potent in its free-machining effects than sulphur, so that a smaller percentage of selenium is required to produce the same free-machining effect. These two advantages combine to produce a steel which is very much cleaner and more uniform than would be a high-sulphur steel having the same machining properties. It is further claimed that the presence of selenium does not interfere with the response of the material to heat-treatment, and it is anticipated that many applications will be found where free-machining S A E alloy steels will prove satisfactory.

The experimental work described in these patents is extremely comprehensive, covering practically all S A E types of analyses—both in the low-carbon carburizing grades and in the higher carbon tempering grades. It is further extended to cover many different types of alloy and plain carbon tool steels.

Offsetting the natural advantages that selenium has over sulphur as a free-machining agent, there appear to be two disadvantages: In the first place, selenium is more expensive than sulphur, so that its use will doubtless be reflected in the higher price of the product. In the second place, all of the work done thus far has been on electric furnace melted steel, which is rather conducive to higher quality than lower costs. It therefore seems likely that the applications of these new free-machining alloy steels will be somewhat selective, and may, at least temporarily, be limited to the manufacture of parts in which the machining costs are relatively high, compared to the weight of the steel.

Stainless Steels Gain Ground Steadily

IN almost every field of industry, we now find stainless steel used for one purpose or another. It is a material that is entering more and more into machine design. Just at the moment, its adoption in the machine-building field is especially noticeable in textile machinery.

According to the American Stainless Steel Co., Pittsburgh, Pa., the outstanding development during the past year has doubtless been the application of stainless steel to textile equipment. Among the applications in machinery of this type may be mentioned winding spool ends, bobbins, winding spool gudgeons, and other winding machine parts, spinning rolls, covers for wet twister rolls, tenter machine clips, and dye cylinders—to mention only the more general applications. The textile industry has been somewhat slow to accept stainless steel as a serviceable and economical material, but at the present time the introduction of this material in that industry is increasing very rapidly.

An interesting demonstration of this could be seen at the Southern Textile Exposition at Greenville, S. C., last spring, where manufacturers of textile machinery displayed their products. A similar exposition was held some years ago in Boston. At the Boston exposition there was scarcely any evidence of stainless steel being used in textile machinery, and it was difficult to convince manufacturers that there was any field in their industry for it, or for any other relatively expensive corrosion-resisting materials. At the recent exposition, there was an entirely different situation. Many exhibitors pointed out stainless-steel parts in their machines and freely predicted increasing applications in equipment built by them.

Shipping Drums Made from Stainless Steel, Used by the Coca-Cola Co.

The trend of the times in the food and beverage manufacturing and handling industries is also toward a much greater use of stainless steel. As an example may be mentioned the Coca-Cola company's New Orleans plant, where mixing tanks and pipe lines have recently been installed using USS 18-8 steel. The company has also in use several thousand stainless steel barrels, ordered after the completion of extensive tests which showed the superiority of this type of equipment for the purposes for which it was installed.

Among other interesting applications of stainless steel may be mentioned an 18-foot open boat made from Allegheny metal sheets, bars, and angles furnished by the Allegheny Steel Co. to the Welin Davit & Boat Co., Newark, N. J., where the boat was built. This boat is 18 feet long, 5 feet 10 inches beam, and 2 feet 5 inches depth, and weighs approximately 1800 pounds. It will be used by Father Bernard Hubbard, the famous mountain climber and geologist, in ascending the Taku River in Alaska to explore the great Taku ice cap.

It is interesting to note that the United States Navy is the biggest consumer of stainless steel. Nine different types are used.

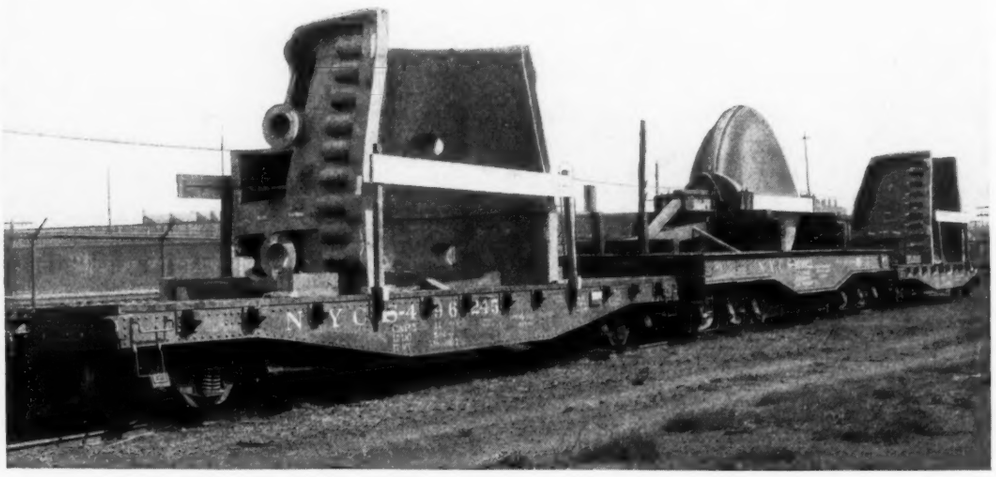
Recent Applications of Nickel Steels and Alloys

ALLOY steels are being used to an ever increasing extent. In 1934, when American steel production was only 11 per cent more than in 1933, the consumption of alloy steels increased 23 per cent. One factor in this trend, according to the International Nickel Co., is the greater diversification that has taken place in the use of alloy steels. While the automotive industry absorbed more than three-fourths of all alloy steel in 1928, and two-thirds as late as in 1933, this industry accounted for barely one-half of the consumption in 1934, notwithstanding the fact that automobile production was much higher in 1934 than in the preceding year and that the applications of alloy steels in the automotive industry suffered no decline.

Obviously, however, the automobile industry could not continue to take so large a proportion of all alloy steels made, since the requirements of the machine tool, farm machinery, oil, railroad, construction, and marine industries have increased fourfold during the last five years. Furthermore, miscellaneous uses, not included in the above classifications, now account for about one-third of the alloy steel production. Among the alloy steels, nickel steel has not only held its own in this increase, but has even found a proportionately greater application.

In the automotive and allied industries one of the most important developments is the increasing use of alloy cast-iron crankshafts and camshafts. Alloy cast camshafts are regularly used in some automobiles; the Ford plants, alone, are reported to turn out some 6000 a day; and crankshafts have been used in passenger cars with promising results. In the truck, tractor, and Diesel engine fields, there are several instances where crankshafts cast from a high-strength nickel iron are regularly used. This material has also been successfully applied for some time in non-automotive crankshafts, such as those used in air compressors, refrigerators, etc.

In the great Boulder Dam project, an achievement universally regarded as one of the greatest engineering feats of our day, alloy steels have played a prominent part. Not less than 1100 tons of nickel alloy steel castings are used for the large butterfly valves, and the specifications call for nickel alloy steels for all important bolts. In the course of the construction of the dam, the largest cableway in the world was built for lowering 50,000 tons of penstock pipe to the tunnel platforms. Nickel alloy steel was used for many of the metal members, such as the sheave shafts, the slack rope carrying system forgings, and the traveling tower track-wheel axles.



A 168-inch Alloy Steel Butterfly Valve Made by the Erie Forge Co., Ready for Shipment to Boulder Dam. The Parts Loaded on the Cars are the Lower Valve Body, Valve Leaf, and Upper Valve Body

New Steel for Cold-Header Dies

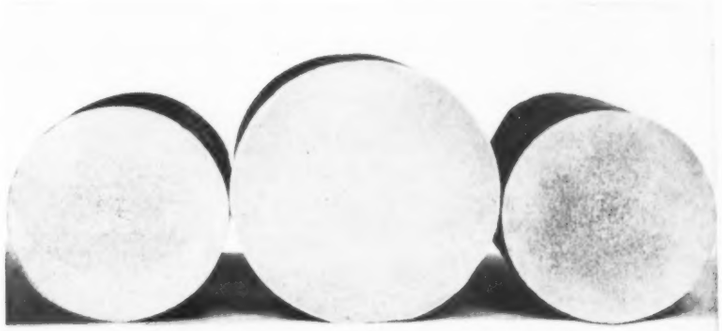


Fig. 1. A Comparison of the Jessop New Process Cold-header Die Steel (Center) with Bars of Good and Cheaper Grades of Carbon Tool Steel (Left and Right, Respectively)

COLD-HEADER dies for forming bolts, screws, and other small parts are subjected to extremely hard service because they force the metal to flow almost like a viscous liquid. Some idea of the pressures involved is gathered from the fact that the metal flow begins at the yield point, which ranges from 30,000 to 40,000 pounds per square inch. The speed at which the dies operate necessitates still greater pressures, while the impact of the die is also a factor of importance.

A steel of great solidity and uniformity, as well as one having tough, hard, wear-resisting surfaces, is therefore essential for cold-header dies. The Jessop Steel Co., Washington, Pa., has recently developed a steel to fulfill these requirements. In developing this steel, the importance of steel cleanliness, of correct working temperatures to obtain uniformity and fineness of structure, and of correct hardening penetration characteristics was recognized.

Steel cleanliness is obtained by separating and removing the top and the center section of the ingot, and by better methods of pouring and cooling the ingots, as well as by close supervision in the selection of scrap, proper deoxidation practice, and careful slag control.

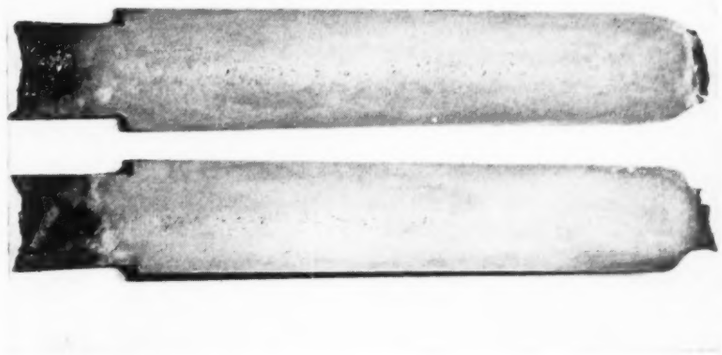


Fig. 2. Two Steel Ingots Over-etched Severely to Emphasize the Segregations which are Generally Concentrated in the Central Part of Ingots

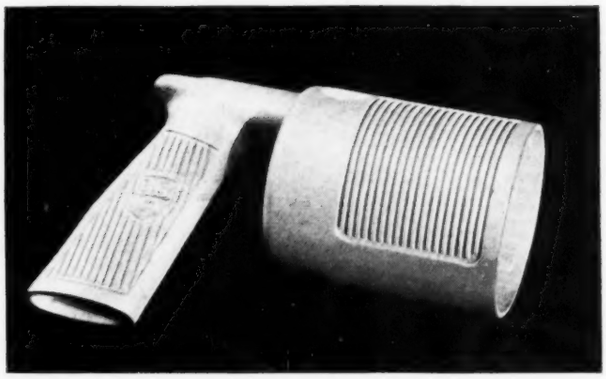
That the extreme top and center portion of an ingot is less pure than the bottom and outer portion will be apparent from Fig. 2, which shows two ingots cut apart and severely over-etched, so as to emphasize the segregation. Of the three hot-etched bars shown in Fig. 1, the one at the left is a good grade of ordinary carbon tool steel, the one in the center is the new Jessop cold-header die steel, and the one at the right is a cheaper grade of carbon tool steel. These specimens were etched in a 50 per cent muriatic acid solution at 160 degrees F., for one hour.

The concern is able to produce the new cold-header die steel with an unusually fine and uniform microstructure by holding the steel within a close temperature range while it is being worked. A temperature of between 1700 and 1750 degrees F. has produced the best machineability and heat-treatment characteristics.

Certain standards of practice have been adopted to insure maximum life of dies made from the new steel. For cold-header dies, the company recommends heating the steel to from 1450 to 1550 degrees F., then quenching in water (using an up and down stream fixture), and drawing in a bath at from 425 to 550 degrees F. For open dies, the company suggests heating to from 1450 to 1500 degrees F., quenching in water (allowing the steel to remain from fifteen to thirty minutes in the tank) and finally drawing at from 425 to 450 degrees F. When punches are being made, the steel should be heated to from 1550 to 1625 degrees F., quenched in water, and drawn in a bath at from 425 to 550 degrees F.

A cold-header die produced from the new steel was employed to head and slot screws from 0.115- to 0.116-inch brass wire at the rate of 7500 an hour. The die lasted sixty-three hours.

Die-Castings Are Steadily Being Improved



An Aluminum Casing and Handle for a Portable Drill — Photograph Courtesy Aluminum Co. of America

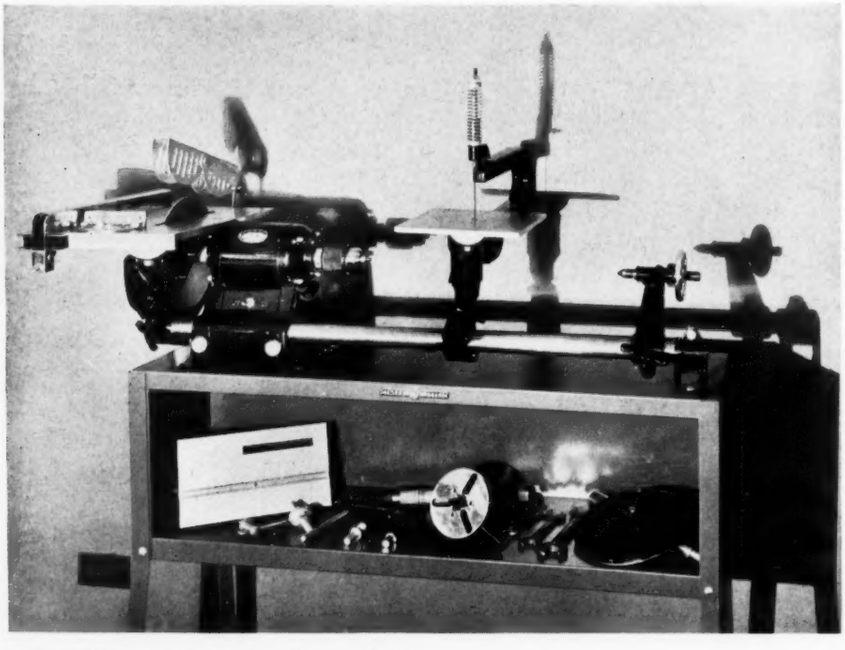
THE growing importance of the die-casting industry has been particularly evident during the present year. According to the New Jersey Zinc Co., this year will unquestionably show the largest production of die-castings ever recorded in the industry. Another outstanding development is the leveling of undesirable and costly peak months, so that a more evenly distributed monthly production may be made possible.

The automotive industry has again taken an aggressive lead. Both the six- and eight-cylinder Oldsmobile cars are equipped with die-cast zinc-alloy radiator grilles. These castings, which weigh about 17 pounds each, probably represent the outstanding die-castings of the year. Incidentally, an unusual number of zinc-alloy die-castings are used in the Oldsmobile assembly, the total weight of die-castings in the car being about 80 pounds. Eight other automobile manufacturers are said to have followed the lead of the Oldsmobile and to be planning to use zinc-alloy die-cast grilles on their 1936 cars.

A slide fastener is another development remarkable for its size. The elements are die-cast from a zinc alloy directly on the fastener tape at an almost unbelievable rate of speed. The machine on which these tiny castings are made was developed by Louis H. Morin, of the Crown Fastener Corporation. The manufacturing possibilities of this machine are extremely promising.

The home appliance field has shown similar increases in new applications. More food mixers, electric fans, washing machines, and automatic refrigerators are equipped with die-cast parts than ever before. The new General Electric "Workshop" shown in the illustration at the bottom of the page has in its assembly over twenty zinc-alloy die-castings, including the gear housing, saw and sand-wheel tables, brackets, and handwheels.

The consumption of zinc alloys by the die-casting industry increased in the first six months of 1935 more than 30 per cent over the same period in 1934. The popularity of die-castings is due fundamentally to the economies which they afford.



Home "Work-shop" Made by the General Electric Co., Including in the Assembly Over Twenty Zinc-alloy Die-castings— Photograph Courtesy New Jersey Zinc Co.

The Use of Aluminum in Machine Design

AMONG recent applications of aluminum is its use for high-speed reciprocating parts. For this purpose, light alloys with high physical properties are of the greatest value.

In modern high-speed machines, it is necessary to be able to start quickly, stop quickly, and reverse quickly. This is particularly true in the case of large reciprocating tables and rotating tables. Here the light alloy, with its consequent reduction of inertia, is a great asset; but it must be strong enough to withstand the heavy stresses met with in high-speed machinery. Aluminum alloys are especially well suited for this type of equipment, and their application to machine design has steadily increased. Some of the machine applications are shaper rams, arbor supports, heads of shears, drill-head assemblies for radial drills, covers and doors, back-rests, center grinder rests, automatic machines, printing machines, capping-machine parts, faceplates, handles, speed controls, drill stands, flexible couplings, etc.

A typical high-speed ram made of aluminum, used on a shaper now on the market, makes from 14 to 200 strokes per minute. It has eight speed changes and can travel from 4 1/2 to 120 feet per minute. This ram weighs only one-third as much as other rams. The lightness of aluminum shear heads permits faster operation of the shear. Aluminum castings in the moving head of radial drills cut down the deflection of the arm, making the machine more accurate for all positions of the head.

Many machine parts that have to be lifted by hand are now made from aluminum, as are also numerous jigs and fixtures. Many machine accessories with aluminum frames can be set up and removed by hand, where a crane would otherwise be necessary.

Aluminum parts such as referred to are usually castings made by one of three processes: They are either sand-cast, permanent-mold cast, or die-cast. Sand castings are most commonly used, because they can be made most economically in small quantities. It is also the only method used when large castings are required. Such castings may weigh thousands of pounds, replacing others made from iron weighing three times as much. The largest aluminum casting ever made weighed 7200 pounds. It was used for a marine Diesel engine. When properly handled in the foundry, most aluminum alloys can be cast in relatively thin sections.

Permanent-mold castings, because of the chilling effect of the mold, are metallurgically superior to either sand castings or die-castings. Tolerances of 1/64 inch can be maintained. Their dense structure and good machineability make them easy and inexpensive to finish.

In the manufacture of aluminum die-castings, extremely close tolerances can be maintained. An allowance of only a few thousandths of an inch is necessary. Many machine parts that are not subjected to extreme stresses, such as covers, are die-cast in aluminum, in order to reduce the weight and the machining and assembly costs. There has been a very great increase in the number of die-cast parts used in almost every branch of industry. The aircraft and automobile industries, obviously, are great consumers of aluminum die-castings; but the so-called heavy machinery industries are also using an increasing number of these castings.

A Bottle-sealing Machine having an Aluminum Star-wheel for Indexing the Bottles

The Broadening Field for Synthetic Plastics

THERE has been a tremendous increase during the past year in the use of plastic materials, particularly those developed to possess unusual strength, attractive appearance, and brilliant, vivid colors.

Among the new developments of the Bakelite Corporation, Bound Brook, N. J., should be mentioned Revolite fabrics and resinoid bonds for plywoods and veneers. Revolite is a flexible form of laminated cloth or paper treated with Bakelite resinoid. This new material differs from the usual laminated sheets made for many years in that the flexibility of products made from it is much greater than anything heretofore available. Laminations 1/8 inch thick may be bent over a 1/4-inch bar without cracking or splitting.

Among the applications of this material are acid-proof linings; packing rings; transformer parts; vacuum brake parts; gaskets; belting; upholstery for automobiles, trolley cars, motor buses, and airplanes; table covers and desk tops; etc.

The General Plastics, Inc., North Tonawanda, N. Y., makers of the synthetic plastic material Durez, emphasizes the increasing use of plastics for household mechanical devices and lighter types of machinery. Industry is becoming more and more aware of the value of prefinished materials for exteriors of products, the appearance of which must appeal to the buyer. Among the devices and machines that have made use of molded Durez housings during the last few months may be mentioned restaurant mixing and whipping machines, scales, adding and calculating machines, portable drills, electric grinding machines, meat grinders, film projectors, cameras, instrument cases, etc. Metal inserts can be molded into the housings.

Inadequate strength has been one of the limitations of phenolic plastic materials for uses of this character, but of recent years, the impact strength has been increased from three to four times. Recent developments indicate that new plastic materials will be available that are practically comparable to metal for a great number of applications requiring impact and torsional strength. As the development progresses, it is likely that many operating machine parts, as well as housings, will be made from plastics, thus eliminating the problems of corrosion, rust, and weight.

Another interesting recent development is the use of the urea synthetic plastic material "Plaskon," made by the Toledo Synthetic Products, Inc., in the weighing scales manufactured by the Toledo Scale Co. The housing or case used for the new Toledo scale measures 17 3/4 by 14 5/8 by 11 1/8 inches, and is said to be the largest plastic molding ever made in commercial quantities.

Among the synthetic plastic materials, Catalin has found some extensive applications outside of the fields for which it was originally intended; yet even in these applications, it takes the place of metal, because in this metal age aluminum or stainless steel would otherwise have been used. We are referring specifically to the application of Catalin in architecture. The warping and distortion under changes of temperature and atmospheric conditions have been eliminated, and plastic materials are now used both for exterior and interior building decoration.

The Skilsaw Hand Grinder for Machine Shop and Foundry Use, Having a Durez-molded Housing which Provides for Lightness and Electric Insulation at the Same Time

The "Aromaire" Vaporizer, Provided with Artistically Designed Bakelite-molded Cabinet

Condensed Review of Some Recently Developed Materials

Arranged Alphabetically by Trade Names

Class of Material	Trade Name	Properties	Applications
Non-magnetic Monel Metal	**Aluminum-Monel**	When a small percentage of aluminum is added to Monel metal, the alloy becomes non-magnetic. This alloy possesses great strength.	Used for airplane parts located close to the compass, and for struts and guide wires on airplanes.
Sheet Steel	**A. W. 70-90**	Sheet and plate steel having a minimum yield point of 70,000 pounds per square inch, a minimum tensile strength of 90,000 pounds per square inch, and a minimum elongation of 20 per cent in 2 inches. Can be welded as readily as soft steel; can be formed cold, and bent back 180 degrees.	For use wherever high strength is required, or where lighter sections are desired than could be used with ordinary steel. Suitable where atmospheric corrosion must be resisted.
Alloy Steel	**Bakadie**	Alloy steel which, after heat-treatment, has a surface hardness of from 63 to 65 Rockwell, and at the same time, has an unusually tough core. The hardness insures good wearing properties and high resistance to abrasion.	Intended especially for use in making molds for producing synthetic plastic parts. Especially suitable for molds in which the impressions are "hobbed."
Synthetic Plastic	**Bakelite BM-2562**	This type of synthetic plastic material holds its dimensions over a long period of time under humid conditions and under high temperatures.	Developed especially for small motor end-frames, and particularly desirable for equipment used in the tropics.
Synthetic Plastic	**Bakelite BM-6260**	Possesses marked resistance to shock. Can be molded with a finish such as is obtained with a wood-flour filled material.	Employed, among other purposes, for telephone parts, where fine appearance must be combined with resistance to shock.
Non-ferrous Alloy	**Basaloy**	Non-shrinking, non-expanding metal alloy with a melting point of 255 degrees F.	Suitable for making small master patterns. Since the alloy is non-shrinking, there is no difference in size between the original and the base-alloy pattern.
Non-ferrous Alloy	**Bendalloy**	Alloy composed of bismuth, lead, tin, and cadmium, having a melting point of only 160 degrees F.—considerably less than the temperature of boiling water.	Used as a filler material in tube-bending operations. With this material as a filler, tubes having walls as thin as 0.007 inch have been bent to small radii.
Beryllium Copper		An alloy containing beryllium, which, by heat-treatment, can be given high tensile strength and high elongation values. Tensile strength in rolled sheets, heat-treated, may be as high as 195,000 pounds per square inch.	Used for electrical contact springs in snap-switches and other electrical applications; also for worm-gears meshing with steel worms, cams in automatic machines, bearings, and die inserts to resist wear in resistance welding machines.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Boron Carbide		An extremely hard material having a compressive strength of 260,000 pounds per square inch; unaffected by the strongest acids and alkalies, and little affected by heat up to temperatures of 1800 degrees F. It is lighter than aluminum.	Used in the cutting and lapping of cemented tungsten-carbides; for wire-drawing dies; pressure blast nozzles; and bearings for electric motors and high-speed spindles in grinding machines.
Brass for Die-casting	**Brastil**	A copper-base brass die-casting alloy having the color of white gold, with high strength and hardness and high resistance to corrosion, fatigue, and shock. Copper content, 81 per cent; tensile strength in die-castings, from 90,000 to 95,000 pounds per square inch, elongation, from 10 to 17 per cent in 2 inches; Brineil hardness, 160 to 180.	Parts ordinarily made from steel because of the strength required can be cast from this alloy. Suitable for high-strength die-castings in general.
Alloy Cast Iron	**Cannonite**	Low-carbon chromium alloy having a higher tensile strength than ordinary cast iron and possessing exceptional wearing qualities.	For sand-casting automobile brake-drums and centrifugally casting cylinder sleeves.
Nickel Iron	**Cecolloy**	A nickel-molybdenum, air-furnace iron alloy having a fine homogeneous grain structure and a tensile strength of from 40,000 to 60,000 pounds per square inch.	Suitable for making large castings weighing up to 50 tons. Used for forming dies, beds of heavy-duty machines, steam cylinder liners and rings, crushing machinery, etc.
Aluminum Alloy	**Ceralumin**	An alloy of low specific gravity and comparatively high strength. Chilled castings, heat-treated, have a tensile strength of from 46,000 to 54,000 pounds per square inch; sand castings, heat-treated, from 38,000 to 40,000 pounds per square inch. Brinell hardness, 130 to 140.	For use wherever light-weight, high-strength castings with high fatigue value are of importance.
Synthetic Plastic	**Cetec No. 1389**	A cold-molded plastic compound with good heat resistance and fine appearance. Unaffected by temperatures up to 480 degrees F. Has high dielectric strength. Transverse strength, 6000 pounds per square inch.	Intended for insulating applications—suitable for heat-control knobs of electric irons, cord-connector plugs, etc.
Chromium Steel for High Temperature		Steel with a chromium content ranging from 4 to 6 per cent resists corrosion, acid attack, and scaling up to temperatures of about 1150 degrees F. Occupies a position intermediate between common steel and stainless steel.	Particularly adapted for use in oil-cracking stills, where temperatures frequently run up to 900 or 1000 degrees F.
Copper Alloy	**Cupalloy**	Copper-base alloy, the electrical conductivity of which approaches that of pure copper, although the alloy is much harder than pure copper and has much greater strength.	Suitable for commutators, slip rings, and other parts of electrical equipment.
Alloy Steel	**Double-Strength Steel**	Copper-nickel-molybdenum steel made in two grades, 1 and 1A. Normalized sheets and strips, Grade 1, have a minimum yield point of 60,000 pounds per square inch; tensile strength, 75,000 pounds per square inch. Grade 1A: Minimum yield point, 70,000 pounds per square inch; tensile strength, 90,000 pounds per square inch. Physical properties of both grades can be increased another 15,000 to 20,000 pounds per square inch by "tempering" the sheets at from 900 to 1000 degrees F.	Particularly advantageous for use in the construction of railway equipment and automotive trucks carrying coal and other corrosion-promoting products.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Magnesium Alloy	**Dowmetal H**	Corrosion-resistant, light-weight alloy. Tensile strength of cast alloy, from 25,000 to 30,000 pounds per square inch; hardness, from 47 to 51 Brinell. Tensile strength of heat-treated alloy, 33,000 to 38,000 pounds per square inch; hardness, from 50 to 53 Brinell.	For use where comparatively high tensile strength and improved resistance to corrosion are required in a light-weight cast alloy.
Magnesium Alloy	**Dowmetal J**	Wrought, light-weight alloy. Tensile strength, from 41,000 to 45,000 pounds per square inch; yield point, from 28,000 to 33,000 pounds per square inch; hardness, from 51 to 58 Brinell.	Used where a wrought, light-weight alloy is required with comparatively high elongation, high fatigue endurance limit, and resistance to corrosion.
Synthetic Plastic	**Durez 75**	Possesses great resistance to moisture and chemicals. Has attractive luster and appearance.	For use where parts are subject to continuous or temporary exposure to moisture, chemical fumes, or weather.
Synthetic Plastic	**Durez No. 1544**	Black compound with an impact strength approximately twice that of ordinary wood-flour filled compounds. Can also be obtained in brown or amber. A black compound, designated as Durez No. 1547, has an impact strength approximately three times that of wood-flour filled compounds.	For use in the manufacture of telephone receivers, football-shoe cleats, instrument cases, cams, etc., that must possess great impact strength.
Synthetic Plastic	**Durez No. 2260 K Black**	The impact strength is approximately one-third greater than that of the general run of phenolic molding compounds. Takes a fine finish. Has a compressive strength of 29,000 pounds per square inch and a heat resistance of 400 degrees F.	Used for instrument cases, adding machine housings, typewriter parts, and boxes or containers that must withstand rough usage. Also for decorative purposes.
Aluminum Bronze	**Elesco**	An aluminum bronze that does not have an affinity for stainless steel, and hence does not load up with particles of steel that scratch the work when used for press dies.	Adapted for drawing and forming dies for stainless steel, but not recommended for blanking or other cutting operations.
Metal Alloy that Fuses with Glass	**Fernico**	A metal alloy with a coefficient of expansion that is practically the same as that of glass and which can be fused with glass without setting up stresses either in the glass or in the alloy. The alloy can be machined, forged, punched, drawn, stamped, soldered, copper-brazed, and welded.	Used wherever tight joints are required between metal and glass, as in vacuum tubes and other devices in which lead-in wires or conducting parts must pass through gas-tight insulating seals.
Zinc-coated Sheets	**Galvannealed Sheets**	Zinc-coated sheets on which the coating adheres so tightly to the base metal that even severe forming operations fail to make it chip, peel, or flake. Can be painted, lacquered, or enameled without preliminary priming or weathering. Can be spot-welded and soldered. Under service conditions, sheets have resisted flaking at temperatures up to 700 degrees F.	Suitable for refrigerators, washing machine parts, metal doors, street cars, buses, furnaces, outdoor metal furniture, highway markers and signs, and any products subjected to moisture or heat.
Acid-resisting Material	**Haveg**	A phenol-formaldehyde plastic with unusual acid-resisting properties. Can be used for temperatures up to 265 degrees F.; does not crack when cooled from this high temperature to the freezing point.	Suitable in the metal-working industries for constructing or lining pickling tanks. Tanks up to 9 feet in diameter by 9 feet in height have been made from this material in a single piece, without seams or joints.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Stainless Steel	**IngOclad**	A material consisting of a sheet of mild carbon steel with a thin sheet of stainless steel welded to it. Combines the non-corrosive properties of stainless steel with the low cost of carbon steel.	Used for cooking utensils, shower-bath compartments, beer barrels, milk storage tanks, etc.
Rubber Protective Coating	**Kelsanite**	Non-inflammable liquid, which can be applied to metal parts by brushing, spraying, or dipping. Protects surface from corrosion or dirt, as it is both waterproof and air-tight. Coating has high adhesive qualities, but does not vulcanize to surfaces on which it is applied. After the coating has served its purpose, it can be stripped off like a cellophane wrapper.	For the protection of parts or entire machines during storage or transportation; for protecting parts to be electroplated at points where the plating is not wanted; for "masking" portions of surfaces that are to be painted.
Monel Metal	**K-Monel**	Has practically the same analysis as regular Monel metal, except that about 4 per cent aluminum is added. Alloy is readily heat-treated, and in its fully hardened condition is over 350 Brinell; but it is also available in softer forms. Tensile strength, over 160,000 pounds per square inch.	For purposes where a combination of the strength of alloy steels with the corrosion resistance of regular Monel metal is important.
Die Steel	**K. O. H.**	A cast-to-shape, oil-hardening die steel having exceptional resistance to wear.	Adapted for making cast-to-shape dies for short-production runs, where the low first cost of the die is important.
Rubber-like Product	**Koroseal**	Does not swell when exposed to many oils and greases nor disintegrate in the presence of corrosive chemicals; will resist the action of chromic acid and hot concentrated nitric acid; can be molded to any shape. Produced in a variety of colors; odorless.	High cost precludes its adoption as a general substitute for rubber, but appears to be superior to rubber for certain applications. Valuable for piston packing, because of the oil-tight seal provided.
Alloy for Sealing to Glass	**Kovar**	An alloy having a thermal expansion that permits permanent sealing of the metal to glass. It is unaffected by mercury and mercury vapors.	Used in the electrical industry for sealing of metal to glass, as in electronic tubes, etc.
Metal Alloy	**Kux Hi-Heat**	Non-oxidizing alloy, highly resistant to corrosion: dense, hard, and tough, taking a high permanent polish Tensile strength. from 45,000 to 50,000 pounds per square inch; hardness, from 250 to 270 Brinell.	Suitable for use where resistance to heat and corrosion is required, as in creamery, dairy, and food-product equipment; also used for die-casting dies and synthetic plastic molds.
Rubber Product	**Laytex**	Highly flexible, high tensile strength, great resistance to compression, high dielectric strength, and important insulation properties. Has a stretch of 750 per cent and a tensile strength of 5000 pounds per square inch.	Especially suitable as an electrical insulation material, both because of its high dielectric strength and because it is not susceptible to moisture.
High-speed Steel	**Mo-Max**	A steel containing 8 per cent molybdenum, 2 per cent tungsten, 4 per cent chromium, and 1 per cent vanadium. Comparable to high-tungsten steel without containing a high percentage of tungsten. Tools made from Mo-Max generally have greater hardness than those made from 18-4-1 high-speed steel, and equal or greater toughness.	Can be used for all types of tools for which regular tungsten high-speed steel is used; presents special advantages in machining work where difficulties have been encountered in using regular high-speed steel tools.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Bronze	**Olympic Bronze**	High-strength copper alloy containing silicon and zinc. Available in three types: Type A—plates, sheets, strips, rods, wire, tubing, forgings, and welding rod; Type B—free-turning wire and rod; Type C—ingots for casting purposes and sand castings. Tensile strength from 40,000 to 150,000 pounds per square inch, the lower figure applying to Type C castings and the higher to Type A wire.	Suitable for all purposes where high-strength, corrosion-resistant machine parts, forgings, or castings are required.
Palladium Leaf		Made from the metal Palladium and beaten between skins in the same way as gold leaf. Can be beaten so thin that 250,000 sheets piled on top of each other make a height of only 1 inch; 2000 sheets, 3 3/8 inches square, weigh 1 ounce, and yet cover an area of 144 square feet. Soft silvery luster of leaf does not tarnish or fade in the atmosphere.	Mainly used in jewelry making and for important electrical contacts; in machinery-building field can be used for marking company names, etc., on machines.
Synthetic Plastic	**Plaskon**	A urea-base synthetic plastic molding material obtainable in all colors from white to lustrous black. Infusible and inflammable, tasteless, odorless, resistant to the action of grease and oils, and to the common organic solvents. Compressive strength, 25,000 to 35,000 pounds per square inch; tensile strength, 8000 to 13,000 pounds per square inch.	Used for practically all purposes where a synthetic plastic material might be applied, and especially where color is of importance. Covers and cases as large as 15 by 15 by 18 inches have been made.
Rubber-base Material	**Plioform**	Thermoplastic material which molds into relatively hard forms rapidly and without vulcanizing. Obtainable in almost any color, except very light shades.	Lends itself to the production of many decorative effects—plain, variegated, or mottled. Because of its comparatively low cost, is suitable wherever decorative effects are desired.
Rubber Lining for Tanks	**Plioweld**	A rubber lining material, about 3/16 inch thick, which provides effective protection against most corrosive liquids, hot and cold; does not oxidize nor crack or buckle under conditions of alternate drying and wetting.	Used for the protection of steel, aluminum, lead, or wooden tanks. A special adhesive derived from rubber actually "welds" the resilient rubber to the tank walls during the process of vulcanization.
Alloy Cast Iron	**Proferall**	Molybdenum-nickel-chromium alloy iron that can be made with a minimum tensile strength of 50,000 pounds per square inch; other grades vary from 60,000 to 80,000 pounds per square inch. Has superior wearing qualities.	Used for cast camshafts and crankshafts for automobiles.
Rubber Protective Coating	**Rubprotex 500 Series**	Rubber product in paint form not affected by acids, alkalies, or petroleum oils of any class or in any concentration, whether gas, liquid, or fume (except agents that are themselves solvents of rubber).	For the complete protection of metal, concrete, and other materials.
Monel Metal	**S-Monel**	Corrosion-resistant material harder than regular Monel metal and offering greater resistance to wear and erosion, particularly steam erosion; is non-galling, especially at high temperatures. Tensile strength, 100,000 to 120,000 pounds per square inch; Brinell hardness, 275 to 350.	For use when regular Monel metal would be used, but when unusual hardness is required of a corrosion-resistant casting.

Review of Some Recently Developed Materials—Continued

Class of Material	Trade Name	Properties	Applications
Phenolic Plastic Material	**Spauldite**	Material manufactured from tightly woven fabric thoroughly impregnated with a phenolic binder. The saturated fabric sheets are forced under heavy pressure and intense heat into a dense homogeneous mass.	Suitable for gears. Gears as small as 1/4 inch pitch diameter, for transmitting 0.06 horsepower per inch of face at a speed of 100 feet per minute, and gears as large as 60 inches pitch diameter, for transmitting 58 horsepower per inch of face at a speed of 3000 feet per minute, have been made from this material.
Synthetic Plastic	**Tenite**	A thermoplastic molding material obtainable both in sheet and granular form. Available in all colors and in sheets in thicknesses from 3/16 to 1 inch and in pieces as large as 20 by 25 inches. Has unusual strength.	May be used for all classes of molded plastics, especially for parts that may be subjected to temperatures up to 160 degrees F. and that must resist vegetable or mineral oils.
Rubber Lining	**Triflex**	A rubber lining consisting of a layer of hard rubber cushioned between two plies of resilient soft rubber. The three plies are vulcanized together to form an integral lining structure which is bonded to a steel tank with an adhesion above 500 pounds per square inch.	For lining steel tanks to meet the severe conditions encountered in cleaning steel with acids. Can also be applied effectively to pipes, valves, fittings, drums, pumps, etc.
Thermostatic Bimetal	**Truflex**	Made in ten different types for temperature ranges of from — 50 degrees F. to 1000 degrees F. Available in helical and spiral coils, rings, flat pieces, U-shapes, and in sheets up to 8 inches wide. It is made in thicknesses of from 0.010 to 0.100 inch, varying by 0.005 inch.	Used for automatically controlling the operation of devices either heated or cooled by electricity, oil, or gas, as, for example, electric refrigerators, irons, toasters, gas ranges, water heaters, and domestic oil burners.
Cork Products	**Vibracork**	Material consisting of pure cork compressed into boards of uniform quality and density. Does not deteriorate or disintegrate, but will last in its original state for years. A cork foundation for machinery makes it possible to operate equipment quietly, with freedom from vibration.	Used as a foundation for motors, engines, fans, blowers, pumps, printing presses, generators, elevator machinery, etc.
Wrought Iron Containing Nickel		The addition of about 3 per cent nickel to wrought iron increases the yield point about 50 per cent and the tensile strength about 25 per cent. A 3 per cent nickel wrought iron has a yield point of 45,000 pounds per square inch and a tensile strength of 60,000 pounds per square inch. Nickel improves the hardness and increases the impact strength. Can be welded successfully by either the oxy-acetylene or electric-arc methods; can be easily machined.	Used for pump socket rods subjected to severe corrosive conditions and high stresses. Field tests show that nickel wrought iron has a service life many times greater than that of other commercially used materials. Other applications are in the manufacture of chain, staybolts, engine bolts, drawbars, boilers, and ship-plates.
Corrosion Resisting Alloy Steel	**Yoloy**	A nickel-copper alloy steel produced in sheets, strips, bars, plates, shapes, wire, and seamless pipe. Has exceptional resistance to corrosion, high tensile strength, high ductility, workability, and weldability. Low-strength Yoloy has a tensile strength of 74,000 pounds per square inch; high-strength Yoloy, 92,000 pounds per square inch.	For use where resistance to corrosion is essential, where abrasion must be withstood, and where long life is desired for the same weight of material, or equal life with lighter weight.

NEW TRADE  LITERATURE

Recent Publications on Machine Shop Equipment, Unit Parts, and Materials. Copies can be Obtained by Writing Directly to the Manufacturer.

Ball and Roller Bearing Appliances

S K F INDUSTRIES, INC., Front St. and Erie Ave., Philadelphia, Pa., 32-page catalogue describing ball and roller bearing transmission appliances. The book shows load ratings and mounting diagrams for ball- and roller-bearing pillow blocks, flanged housings, take-up boxes, post and drop hangers, floor stands, replace boxes, lock-nuts, and lock-washers. A section is devoted to a discussion of bearing problems, giving suggestions for the selection of ball and roller bearings, and dimensional and load data. It is mentioned that more than 11,000,000 S K F bearings are in use today in transmission equipment throughout the world.

Apprentice Training

INTERNATIONAL CORRESPONDENCE SCHOOLS, Scranton, Pa. Bulletin entitled "The Related Instruction Problem of an Effective Apprentice Training Program," dealing with the problem of the scarcity of skilled workers and describing a system by means of which industry or the regular school system cooperates with the I.C.S. in training apprentices under what is known as "Supervised Correspondence Instruction."

Tool Steels

CRUCIBLE STEEL CO. OF AMERICA, 405 Lexington Ave., New York City. Catalogue covering the high-speed and tool steels, stainless steels, alloy and machinery steels, and special steels made by this company. Information is given on the selection of tool steels and a table gives three choices of steels for a wide range of applications. The book also contains general working instructions for the various classes of steels.

Welding Electrodes

WILSON WELDER & METALS CO., INC., Wilson Bldg., North Bergen, N. J. Catalogue giving the metallic composition, physical properties, and applications of Wilson welding electrodes, together with complete outline of welding procedure. Numerous applications to difficult arc-welding operations are included. The catalogue is a fine example of the printer's art, as well.

Milling Cutters

INGERSOLL MILLING MACHINE CO., Rockford, Ill. Catalogue 51, containing data on Ingersoll milling cutters, featuring especially the new Zee-Lock cutter blade. Among the other tools shown are face mills; end-mills; side milling cutters; helical milling cutters; and cemented-carbide cutters. Several pages are devoted to special milling cutters.

Threading Tools

GEOMETRIC TOOL CO., New Haven, Conn. Booklet containing data on the Geometric new Style DJ solid adjustable die-head. Bulletin illustrating and describing Geometric stationary self-opening die-heads for use in hand screw machines, turret lathes, and similar equipment. Leaflet descriptive of Geometric Class SJ solid adjustable taps.

Tool Equipment

SCULLY-JONES & CO., 1901 S. Rockwell St., Chicago, Ill. Catalogue 105, covering drilling, tapping, counterboring, reaming, and milling tools, as well as a complete line of boiler tools. A number of new developments in the tool industry are included, as well as detailed line drawings and complete engineering data.

Synthetic Plastic Materials

CONTINENTAL DIAMOND FIBRE CO., Newark, Del. Catalogue entitled "Dilecto," giving information pertaining to the properties and uses of the synthetic plastic material Dilecto, a laminated phenolic material. The catalogue contains unusually complete data on the subject, including suggestions for machining Dilecto.

Synthetic Rubber

B. F. GOODRICH CO., Akron, Ohio. Booklet entitled "Koroseal," describing a rubber-like material made in a variety of compounds ranging from bone-like hardness to a liquid. The material is suitable for gaskets, sealing members on reciprocating pistons, tubing, flexible sleeve service, flexible molds, and platers' dipping racks.

Variable-Speed Transmissions

REEVES PULLEY CO., Columbus, Ind. "Speed Control Handbook," 111 pages, 5 1/2 by 8 inches, bound in cloth. This handbook contains complete information pertaining to the construction and application of variable-speed controls and transmissions. It is far more than a catalogue, and well deserves the designation "handbook."

Plating Equipment

UDYLITE CO., Detroit, Mich. Circular illustrating two designs of Udylite plating barrels, one for regular production work and the other (known as the "Handiplater") for small lots or for the production plating of small parts.

Circular briefly describing Udylite plating rheostats and line switches.

Alloy Steels

BETHLEHEM STEEL CO., Bethlehem, Pa. 16-page booklet 88, entitled "Some Notes on Bethlehem Alloy Steels," containing a physical-property chart for each of seven groups of alloy steels, which are also quite fully described. Applications of the different types of steel are outlined.

Maintenance Equipment

IDEAL COMMUTATOR DRESSER CO., Sycamore, Ill. Catalogue and reference book entitled "Motor and Other

Maintenance Equipment and Electrical Specialties," giving information about commutator and slip-ring maintenance, resurfacers, portable precision grinders, and other maintenance tools and equipment.

Testing Machines

AIR REDUCTION SALES CO., 60 E. 42nd St., New York City. Folder illustrating and describing the portable Airco tensile and bend testing machine. The folder gives complete directions for the use and application of the testing machine, especially for the testing of the strength of welds "on the job."

Material-Handling Equipment

LEWIS-SHEPARD CO., 236 Walnut St., Watertown, Mass. Folder 311, containing information on methods of moving, stacking, or storing manufactured articles efficiently, and illustrating various types of lift trucks and other material-handling equipment made by the concern.

Abrasive Disks

CHARLES H. BESLY & CO., 118-124 N. Clinton St., Chicago, Ill. Catalogue entitled "Besly Titan Steelbacs." The catalogue completely describes the construction of these abrasive disks, and gives instructions for their application and use in grinding operations.

Alloy Steel

YOUNGSTOWN SHEET & TUBE CO., Youngstown, Ohio. Booklet entitled "Yoloy," a corrosion-resistant, high-tensile strength, high-ductility alloy steel. The booklet gives a summary of the properties of this steel, with information on its characteristics and application.

Welding Equipment

HOBART BROS., Troy, Ohio. Booklet entitled "The Many Profitable Uses of the New 40-Volt Simplified Arc Welding," outlining a few of the modern applications of electric arc welding in many industries and showing this company's latest developments in arc-welding equipment.

Motor Starters

LINCOLN ELECTRIC CO., Cleveland, Ohio. Circulars illustrating and describing Lincoln automatic, across-the-line type motor starters, designed to prevent accidental starting and to permit taking advantage of the full capacity of the motor without danger of burning it out.

Alloy Sheet Steel

REPUBLIC STEEL CORPORATION, Massillon, Ohio. Publication entitled "Alloy Sheet Steel (Copper-Nickel-Molybdenum)," describing the characteristics of the material known by the trade name "Republic Double Strength Steel."

Diamond Dressing Tools

KOEBEL DIAMOND TOOL CO., 1221 Oakman Blvd., Detroit, Mich. Booklet entitled "For Grinder Men Only," giving information pertaining to the proper method of dressing grinding wheels and care of diamond dressing tools.

Leather Belting

GRATON & KNIGHT CO., Worcester, Mass. Publication entitled "Performance Book," containing a record of the experiences of belt users, from actual case studies. The information pertains especially to the company's "Research" belt.

Industrial Microscopes

BAUSCH & LOMB OPTICAL CO., 619 St. Paul St., Rochester, N. Y. Catalogue entitled "Laboratory Microscopes and Accessories," illustrating and describing several types of microscopes suitable for laboratory and industrial use.

Ball and Roller Bearings

GWILLIAM CO., 360 Furman St., Brooklyn, N. Y. Catalogue illustrating and describing the line of ball and roller bearings made by this company, including complete tabular data pertaining to these bearings.

V-Belts

MANHATTAN RUBBER MFG. DIVISION OF RAYBESTOS-MANHATTAN, INC., Passaic, N. J. Bulletin 6840, describing Condor V-belts. Numerous diagrams give technical information of value to users of V-belts.

Screw Machine Stock

UNION DRAWN STEEL CO., Massillon, Ohio. Folder bringing out the advantages of cold-drawn screw machine stock having machineability amounting to from 15 to 25 per cent over that of hot rolled stock.

Pipe-Threading Machines

QUIJADA TOOL CO., 620 N. San Gabriel Blvd., San Gabriel, Calif. Circular illustrating and describing the No. 2 Quijada pipe-threading machine, especially intended for use in the plumbing industry.

Surface Grinders

HAMMOND MFG. CO., 3089 E. 80th St., Cleveland, Ohio. Leaflet illustrating and giving the capacity of the No. 2 Hammond precision toolroom surface grinder, formerly a product of the Monarch Machine Tool Co. but now manufactured by the Hammond Mfg. Co.

Gear Reducers

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis. Leaflet 2203 entitled "Gearmotors," illustrating and describing the company's self-contained speed reducers with integral or attached motors.

Heat-Treating Furnaces

AMERICAN GAS FURNACE CO., Elizabeth, N. J. Folder descriptive of this company's improved tool-room oven furnace which can be operated from the regular electric light circuit.

Hard-Facing Metal

COLMONOY, INC., P. O. Box 977, Los Nietos, Calif. Booklet describing the properties and application of a new wear-resistant, corrosion-resistant, and heat-resistant overlay metal.

Insulating Material

JOHNS-MANVILLE, 22 E. 40th St., New York City. Booklet IN-7A, entitled "Barriers to Industrial Waste," listing more than half a hundred insulating products made by this company.

Die-Sinking Cutters

PRATT & WHITNEY CO., Hartford, Conn. Circular 415, illustrating, describing, and giving dimensions of newly designed die-sinking cutters intended for high speeds and feeds.

Blowers

ROOTS-CONNERSVILLE BLOWER CORPORATION, Connersville, Ind. Bulletin 21-B-17, describing the Victor-Acme rotary positive blowers for pressure or vacuum service.

Seamless Steel Tubing

SUMMERILL TUBING CO., Bridgeport, Montgomery County, Pa. Circular listing some unusual uses of seamless steel tubing.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Fellows Hourglass-Worm Gear Shaper and Worm-Lapping Machine

A gear shaper particularly adapted to the cutting of hourglass worms for steering gears and reduction drives was exhibited for the first time at the Cleveland Show by the Fellows Gear Shaper Co., Springfield, Vt. The feature of this machine, which is illustrated in Figs. 1 and 3, is its ability to produce worms of high accuracy and unusual smoothness of finish at a high rate of production.

The cutter rotates in mesh with the work and reciprocates at the same time that it feeds to the required depth. The work makes one complete revolution after the cutter has reached full depth, thus producing the unusually smooth finish. The cutter is fed to depth by a cam which provides a dwell for the finishing cut, the same cutter being used for both roughing and finishing.

The cutter is withdrawn from the work at the end of the operation by a quiet-operating relieving mechanism. The saddle which carries the cutter-spindle is mounted on trunnions which permit the saddle to be rocked back and forth for the cutting and return strokes.

Provision is made through change-gears for cutting different numbers of teeth or threads, and for obtaining different depths of cuts and rates of rotary feed. There is also a feed-reversing mechanism which

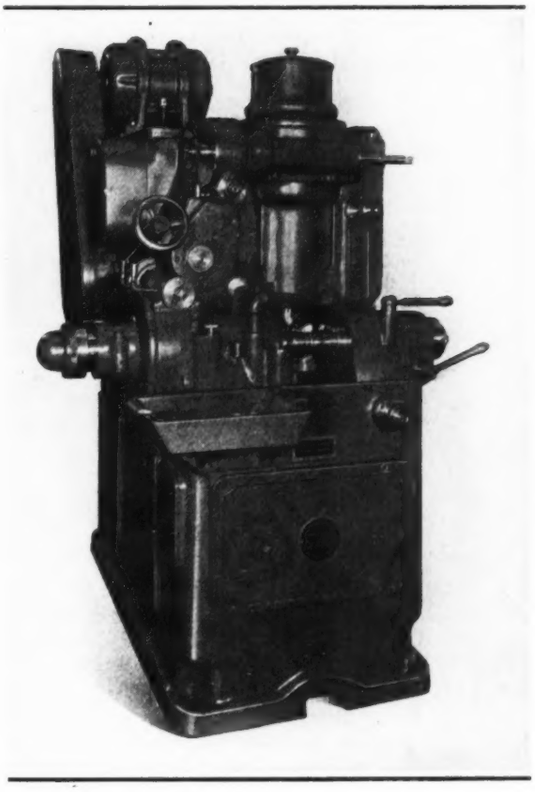


Fig. 1. Fellows Gear Shaper Designed for the High-speed Production of Hourglass Worms

Fig. 2. Machine Built for the Lapping of Straight Worms After Hardening or Grinding

changes the direction in which the cutter-spindle rotates, thus enabling the cutting of worms having right- or left-hand threads.

This machine is particularly adapted to a motor drive and for an electrical control. Its capacity is governed to a large extent by the diameter of the gear that mates with the worm, the cutter being approximately the same in diameter as the mating gear.

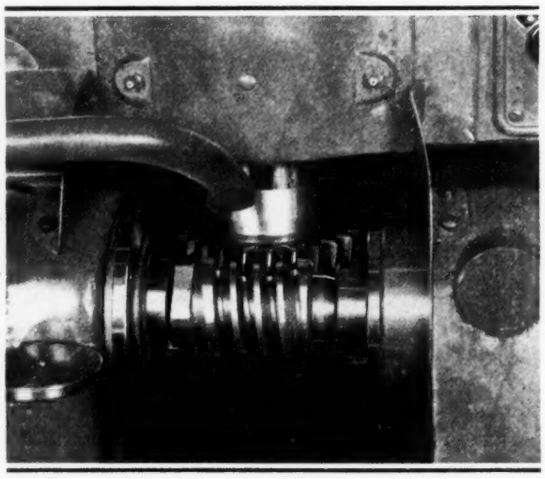


Fig. 3. Cutting an Hourglass Worm on the Fellows Gear Shaper Shown in Fig. 1

The same concern also exhibited for the first time a machine designed for lapping straight worms after hardening. This machine, which is shown in Fig. 2, employs a throated cast-iron worm-wheel as a lap in the manner shown in Fig. 4. The work is held on an arbor which is supported by driving and live centers. The tailstock center is mounted in ball bearings which are sealed to prevent the entrance of lapping compound.

The table which carries the work is reciprocated by a crank mechanism that is driven by a 1/3-horsepower motor and a gear reduction unit. The travel of the table is adjustable for length of stroke. The headstock center is driven by a 1/2-horsepower motor through change-gears, and the lap is rotated by the work. An adjustable brake on the lap-spindle provides resistance for expediting the lapping action. Time relays connected with the headstock motor control the number of revolutions of the work in either direction for lapping the two sides of the thread.

When this machine is employed for lapping worms after hardening, the lap is made from a fine-grain cast iron and a fairly coarse abrasive is used, whereas when the machine is employed for lapping ground worms, the laps are made from pressed cork and a fairly fine-grain abrasive is used, which gives an unusually high polish. The lapping compound is mixed with a non-fluid oil which keeps the abrasive in suspension, and is pumped to the lap and work. This machine has a capacity for lapping worms up to 4 inches in pitch diameter and 5 inches in thread length.

Gray Nibbling Machines of New Size

Two new sizes have recently been added to the line of turret-head metal cutters or nibbling machines built by the Gray Machine Co., Box 596, Philadelphia, Pa. One of these has an 18-inch throat and capacity for sheet metal up to 1/4 inch thick, while the other has a 24-inch throat and capacity for sheet metal up to 3/16 inch thick. Machines of eleven sizes and capacities are now included in the line.

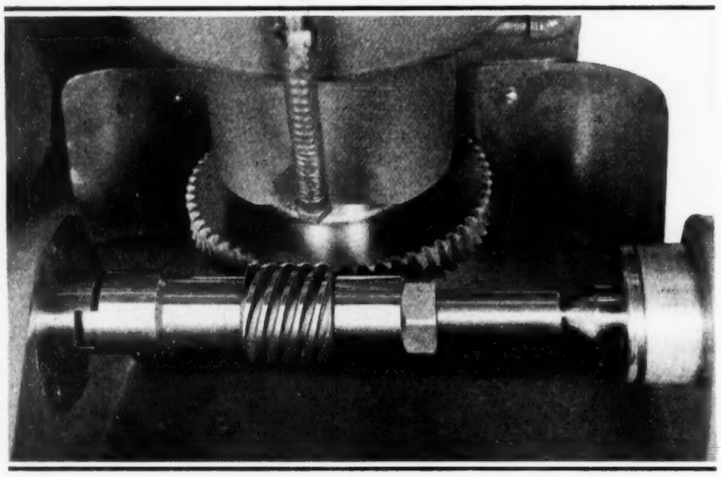


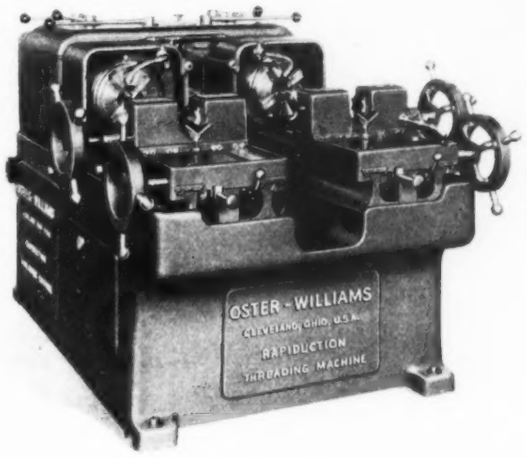
Fig. 4. A Close-up View Showing the Type of Cast-iron Lap Employed in Lapping Hardened Straight Worms

The new machines are similar in design to those previously described in MACHINERY, except for several improvements, including an arrangement which overcomes lost motion in the strippers. This provision enables the operator to follow lay-outs easily, as all chatter and vibration of the stripper are eliminated. The improvement consists of a weighted screw which is adjustable so that the weight can be maintained just past the center when the screw is tight against the shank of the strippers. Lock-nuts are no longer necessary.

Another feature of the new machines is that cutting oil is led by a channel direct from a reservoir to the cutting tool. The flow of oil is uninterrupted.

Oster-Williams Bolt-Threading Machine

One of the exhibits of Oster-Williams, 2057 E. 61st Place, Cleveland, Ohio, at the Machine Tool Exposition was the bolt-threading machine here illustrated, which is built in both single- and double-spindle types. This machine is intended for high production on standard runs of bolts, and also for use on an unusually wide variety of special work. The regular bolt range covers all sizes from 1/2 inch to 2 1/4 inches, and threading is done at spindle speeds of from 32 to 196 revolutions per minute. The spindle bore is 3 1/4 inches.



Oster-Williams Bolt-threading Machine, Built in Single- and Double-spindle Models

Right- and left-hand threads can be cut simultaneously on the double-spindle machine. The spindles are mounted in preloaded tapered roller bearings, and the headstock shafts are also mounted in tapered bearings. The vise carriages are adjustable laterally and vertically for wear.

The longitudinal feeds and cross-feeds.

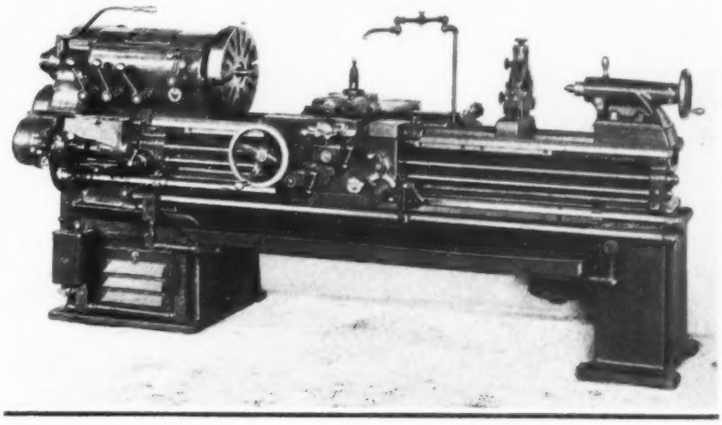
The clutch and brake control for the spindle may be operated either from the head end of the lathe or from the apron. The carriage has a bearing on a flat way of the bed and on a vertical face for which adjustable taper gibs are provided.

The 14-inch lathe illustrated has a swing of 16 1/2 inches over the bed ways, a swing of 10 3/4 inches over the carriage bridge with a cover provided, and a swing of 9 1/2 inches over the carriage bridge when the machine is equipped with a taper attachment. The spindle speeds range from 18 to 536 revolutions per minute. The feeds range from 0.0025 to 0.160 inch per spindle revolution, while threads from 1 1/2 to 96 per inch can be cut.

Reed-Prentice Sixteen-Speed Tool-Room Lathes

Gears of hardened chromium-nickel steel, with teeth finished accurately on a Pratt & Whitney gear grinder, are provided in the headstock of a new line of tool-room lathes introduced at the Machine Tool Show by the Reed-Prentice Corporation, Worcester, Mass. This new line includes lathes of the 14-, 16-, 18-, and 20-inch sizes. Sixteen spindle speeds are available on each machine. Speed changes are made through sliding gears mounted on multiple-spline shafts. They are effected by moving only four levers at the front of the headstock. The spindle is mounted in four Timken tapered roller bearings, and anti-friction bearings are also supplied for the backshafts. Combined oil-pump and splash lubrication are provided for the headstock.

Forty-nine changes of feeds and threads are available. Another feature is a built-in lead-screw reverse mechanism. The box type apron is equipped with an oil-pump which provides lubricant for all bearing surfaces of the apron, bed, carriage, and cross-slide. There is a separate clutch control on the apron for



Reed-Prentice Tool-room Lathe with Ground Headstock Gears and Other Improved Features

GE Cycle Recorder for Welding Operations

A device which gives pictorial evidence of the length of time that current flows in an alternating-current circuit has been brought out by the General Elec-

tric Co., Schenectady, N. Y. This device records, on a strip of paper, cycles of duration of current flow, and it is intended for use with resistance welder timers. It can be used for calibrating or adjusting the timers or for providing a permanent record of the time consumed in making welds.

By indicating when an accurate resetting for a welding time has been obtained, the device is useful in duplicating welds previously found to be satisfactory. The instrument, therefore, not only records the optimum welding time for a specific job, as determined by experiment, but it enables production welding machines to be easily set to duplicate this time. The recording device is inkless, a stylus carried on a vibrating reed being pressed lightly on a moving strip of thin paper under which a graphite roll rotates.

Rasmussen Power Sawing Machine

A new power metal sawing machine has been developed by the Rasmussen Machine Co., 1014 Eighth St., Racine, Wis. This machine can be operated either as a fully automatic machine when employed for cutting off duplicate pieces from bar stock or it can be set to complete one cut and to stop when the cut is finished. In addition to its use as a cutting-off machine, it can also be used for deep slotting and similar work.

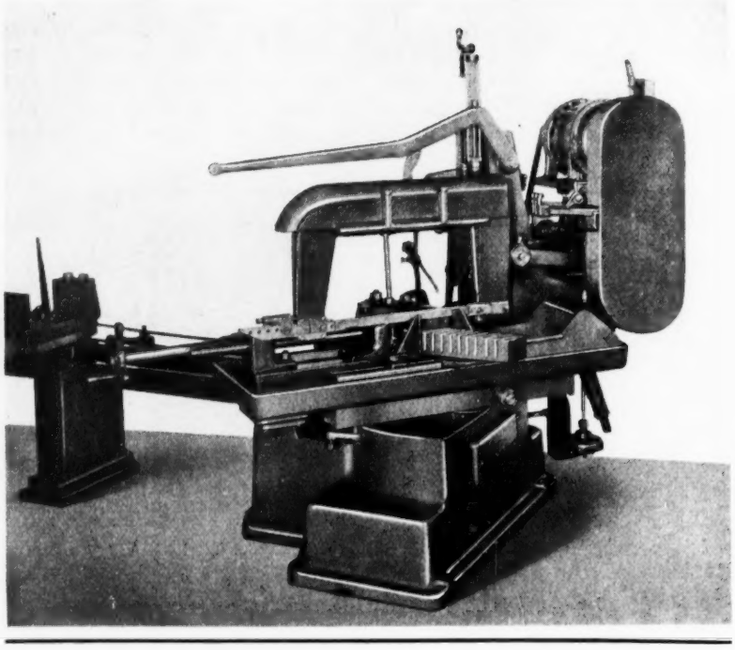
The machine will make either square or angular cuts. For making angular cuts, it is swiveled on its base and set to the required angle by a graduated dial. The vise on the machine is also swiveled and set to the same angle, so that it is brought back into line with the stock feed. This feed has a graduated scale for cutting off pieces to any required length. When a specified number of pieces is to be cut off, a dial mechanism on the machine is set to the required number. When the last piece is cut off, the mechanism trips an electric switch, which stops the machine.

When used for cutting off duplicate work, the machine is set up and started, after which the operation is entirely automatic. The complete cycle is as follows: A trip engages the clutch for the stock feed, and the bar stock is gripped and moved forward into position for the next cut. Then the stock-feeding drive is disengaged and the saw begins to move down to the work. A stop on the saw frame vertical slide is engaged and tightens the vise on the work. Now, the saw is being fed into the cut. The saw cuts on the draw stroke, and a cam mechanism lifts the saw clear of the work on the return stroke. When the cut has been completed, the feed is tripped and the power quick return of the saw is engaged, returning the saw to the starting point, releasing the vise, and placing the machine in readiness for a new cycle.

As part of the feed mechanism, there is a spring compensating device. The tension of the spring of this compensator can be regulated to adjust the amount of downward pressure on the saw blade. The saw is fed down against the resistance of oil in a dashpot. The speed with which the saw is fed to the work can be accurately regulated. An ingenious mechanism safeguards the saw blade and feeding arrangement from damage in case abnormal conditions should be encountered.

In addition to the automatic control described, the machine can be hand-operated. The change from automatic to hand control is made by turning a knob.

When the machine is used automatically, should it happen that the stock is all consumed before the required number of pieces are cut off, an automatic trip stops the machine. The stock feeder provides for cutting off pieces up to 24 inches in length. If longer pieces are to be cut off, this can be done by adjusting the stop on the stock-feeding mechanism to a position which is a fraction of the length of the required piece. A lever is then pulled, causing the stock feed to repeat the required number of times before the cut is started.

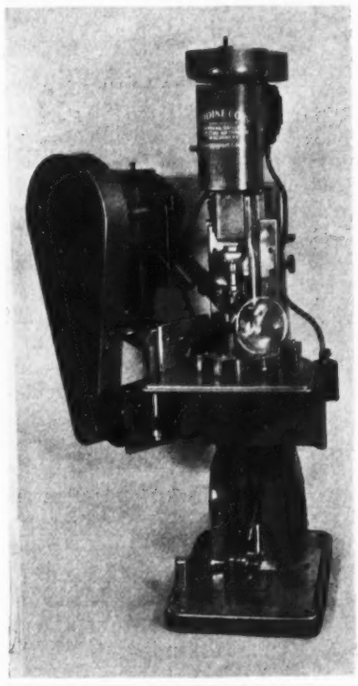


Rasmussen Power Metal Sawing Machine which can be Used as a Fully Automatic or as a Hand-operated Machine

Bodine Automatic Screw-Inserting Machine

A completely automatic machine has recently been developed by the Bodine Corporation, 1720 Fairfield Ave., Bridgeport, Conn., for inserting screws in a wide variety of work. One or more hoppers are provided for feeding the screws to the screw-driving spindles as required. These hoppers are provided with individual motor drive, thus giving flexibility of location and insuring an adequate supply of screws to the spindles at all times. The hoppers feed the screws close to the inserting points.

The machine is built with either a dial type of knee or a plain knee. The illustration shows a plain-knee machine equipped to drive two screws into the handle of Silex drip type coffee pots. One screw is driven each time the operator depresses the treadle. While this machine has been designed primarily for driving machine screws up to 1/4 inch, attachments can be made for larger screws.



Bodine Automatic Screw-inserting and Screw-driving Machine

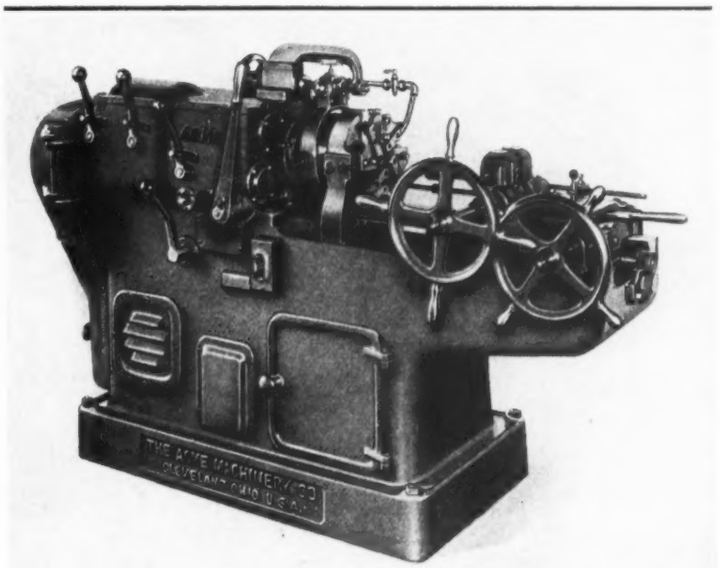


Fig. 1. Acme Bolt-threading Machine with Handwheel Adjustment for Depth of Cut

Acme Bolt-Threading Machine

An unusual feature of a bolt-threading machine recently developed by the Acme Machinery Co., Cleveland, Ohio, is a handwheel adjustment for the depth of cut. This adjustment can be made without stopping the machine. The handwheel is located near the right-hand end of the headstock, as may be seen in Fig. 2. Two handwheels are furnished on machines equipped with a lead-screw. One handwheel is for adjusting to the correct diameter of the cut, while the other is used to make adjustments during roughing cuts. In making an adjustment, the exact setting of the die is indicated by means of a graduated scale above the adjusting screw which is actuated through the handwheels.

The machine can be furnished with either a tangent die-head or a hobbed die-head. The tangent die-head is especially suited to quantity production and is standard equipment for production work up to 2 inches in diameter. This die-head has only two main parts, a die ring and a barrel. Right- or left-hand threads of the same pitch and of any diameter can be cut with the same die-head by merely providing right- and left-hand die-holders. The hobbed type of die-head is better adapted to frequent changes and short runs of work.

The die-head is tripped open automatically at the end of the cut by a cam operated by the carriage. The die-head may also be opened or closed by hand through a lever on the headstock. The carriage is provided with small reservoirs at each end to insure constant lubrication of the ways. Guards attached to the carriage to protect the ways from chips and dirt telescope under the headstock.

For cutting threads of accurate lead and of coarse pitch, a lead-screw drive is required for the carriage. The lead-screw is mounted in pre-loaded anti-friction bearings directly below the center line of the spindle so as to eliminate any tendency of the carriage to bind on its ways. The lead-screw is equipped with a tubular cover to protect it from dirt and chips. Both right- and left-hand threads can be cut with the lead-screw advancing the carriage. Lead-screws can be quickly interchanged. When the

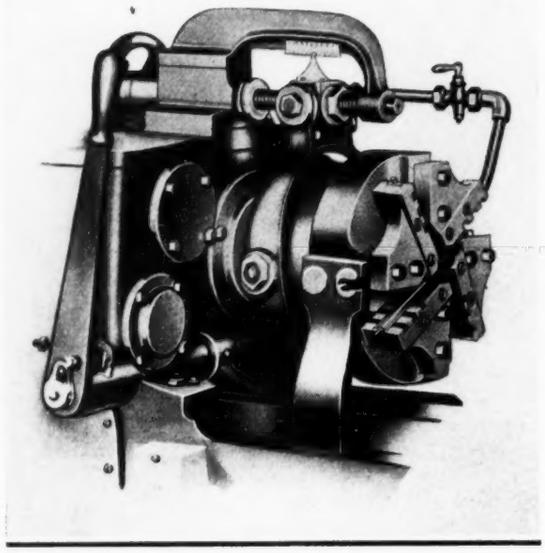


Fig. 2. The Setting of the Die-head is Shown by a Graduated Scale

Ortho-Sterco Camera which Takes Photographs that Show Objects in Relief

power-feed attachment is required, a special headstock and carriage are necessary, and so the application of this attachment to the bolt-threader can be made only when the machine is being built.

This bolt-threading machine is driven by a motor mounted on a hinged plate in the base. Power is transmitted from a single pulley to the main drive through multiple V-belts. The machine is of a streamline design.

Walworth Pipe Wrench with Cross-Locked Jaw

An improved pipe wrench with features that are said to greatly increase its life has recently been announced by the Walworth Co., 60 E. 42nd St., New York City. This wrench has a renewable lower jaw of hardened steel with cross-tongues that seat into cross-slots in the handle. The jaw is locked in place, so as to eliminate backward shear on its pin and prevent loosening in service. However, it can be easily replaced when necessary. The wrench is given a Parkerized rust-proof finish and is provided with a cadmium-plated nut.

Ortho-Stereo Camera which Reproduces Objects in a Three-Dimensional Perspective

One of the unusual exhibits of the Bausch & Lomb Optical Co., 619 St. Paul St., Rochester, N. Y., at the National Metal Congress will be an Ortho-Stereo camera which applies the principles of stereoscopy to photography. This camera takes photographs that show an object in a three-dimensional perspective, that is, as if in relief. The result is an impression that the ordinary photograph cannot achieve.

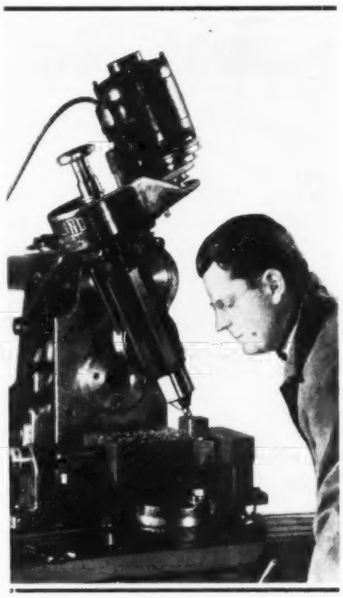
In the metal industries, this camera will be of particular use in obtaining records or "stereograms" of fractures, mechanical parts, tools, inventions, etc. These stereograms can be filed conveniently for future reference or readily sent through the mail. Pictures can be made with magnifications from 1X to 24X by merely substituting the proper photographic objective.

The camera eliminates the need of transposing the stereophotographs in mounting, because it automatically transposes the pictures and records them on one 5- by 7-inch plate. The operator has only to use a single piece of printing paper, develop and mount it. The camera is of the fixed-focus type and can be used vertically or horizontally.

Eklind Universal High-Speed Milling Head

A universal high-speed milling head of improved design, recently brought out by the Eklind Tool & Mfg. Co., 4642 Ravenswood Ave., Chicago, Ill., is being placed on the market by the Universal High Speed Tool Co., 548 W. Washington Blvd., Chicago. This head is adaptable to any milling machine. It is provided with a bracket that is bored to suit the milling machine over-arm. Adapters are available for mounting the head on rectangular over-arms and for mounting the heads so as to enable compound angles to be obtained.

The head is clamped to the end of the over-arm, where it affords maximum visibility of the work. It can be adjusted vertically for milling work that is limited in size only by the distance from the lowest position of the milling



Eklind Universal Milling Head with Speeds up to 5000 R.P.M.

machine table to the over-arm. The attachment is adjustable in and out. Five spindle speeds of 450, 800, 1400, 2400, and 5000 revolutions per minute are available with a motor running at 1725 revolutions per minute. The motor is of the reversible type.

Mercury Electric Trucks

The illustration shows a high-lift industrial truck designed especially by the Mercury Mfg. Co., 4100 S. Halsted St., Chicago, Ill., for use in moving and setting heavy machinery and similar millwright applications. A double-drum motor-driven winch with a capacity of 4000 pounds, is mounted above the battery compartment. Cable sheaves are provided for conveniently handling any type of equipment.

The truck has a capacity of 6000 pounds. It is equipped with a four-wheel trailing axle, a winch-motor controller, an ampere-hour meter, a hydraulic lift, a double-reduction bevel-and-spur gear drive for the axle, safety brakes in the wheels, ball bearings throughout, a magnetic contactor control, and an automatic overload protection.

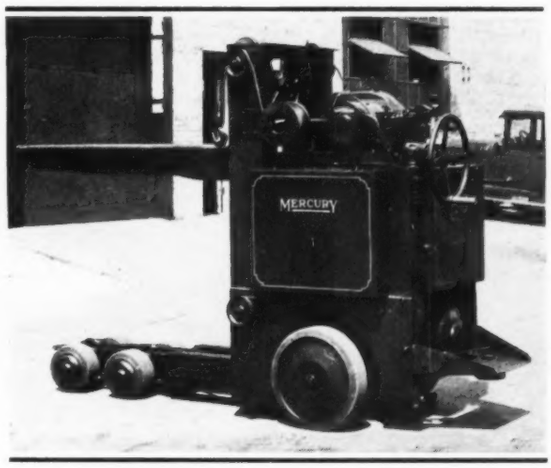
The same concern has also developed a truck designed especially for handling strip steel and other material in coils. This truck is equipped with a ram that is entered into the coils to be transported. Loads up to 4500 pounds can be carried. This truck is also provided with a hydraulic lift and positive overload protection.

Landis Pipe Facing and Beveling Attachment

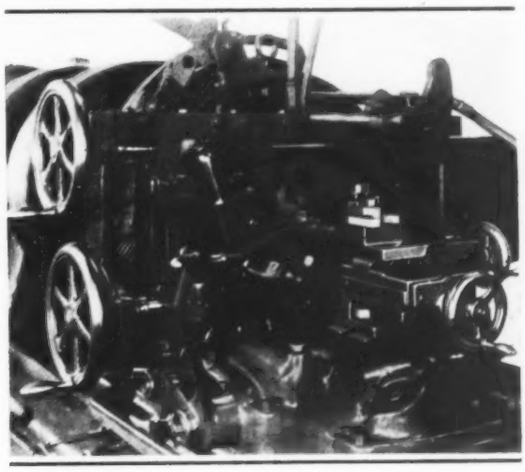
Heavy-wall piping, such as is used in oil refineries, chemical plants, etc., is now being made with a new type of screwed joint which requires that, in addition to the thread-cutting operation, the pipe be faced, beveled 20 degrees on the inside, and recessed at the shoulder of the thread. A smooth finish and concentricity of all machined surfaces are important requirements. This type of joint is used on piping subject to unusually high pressures and severe temperature changes.

In order to combine these several machining operations with the cutting of the thread, so that the pipe is completely machined at one chucking, the Landis Machine Co., Inc., Waynesboro, Pa., has developed a facing and beveling attachment for use on the pipe-threading and cutting-off machine built by the concern. This attachment is built directly into the standard machine and the machine is fitted with a lead-screw. The illustration shows a close-up view of the attachment in place on a machine.

The cutting tools on the attachment can be adjusted for facing and beveling all diameters of pipe within the range of the machine. The lead-screw provides the positive feed necessary to insure threads of correct form and lead. This is particularly important with pipe of the larger diameters, since the threads are straight and not tapered, as in the case of ordinary screw joints of piping.



Mercury Truck with Double-drum Winch which Adapts it Especially to Millwright Applications



Landis Pipe Threading and Cutting Machine Equipped with Facing and Beveling Attachment

Federal Percussion Welder

A percussion type of welding machine has recently been designed by the Federal Machine & Welder Co., Warren, Ohio, for welding handles to saucepans, dishpans, etc., that are later enameled. The handles are tubular, and at one end the tubular section is shaped to correspond with the contour of the pan. In the past, the practice was to spot-weld a flat bent-over extension of the handle to the pan, and the operation was performed at the rate of five a minute. This method proved unsatisfactory because acid or alkali used in pickling and washing often became trapped between the flat surfaces of the handle and the pan, and caused gas in the vitrifying process, with the result that losses from enameling imperfections ran as high as 30 per cent.

In the operation of the percussion welder illustrated, a split electrode is clamped around the saucepan handle, while another holds the pan itself. By depressing a foot-treadle, the handle and pan are brought into contact and a heavier electric current than is employed in spot-welding is applied for one-sixtieth of a second. This gives a percussion weld in which no foreign matter is trapped and around which enameling can be done with minimum spoilage. A girl or boy operator can weld the handles to the pans at the rate of twenty a minute.

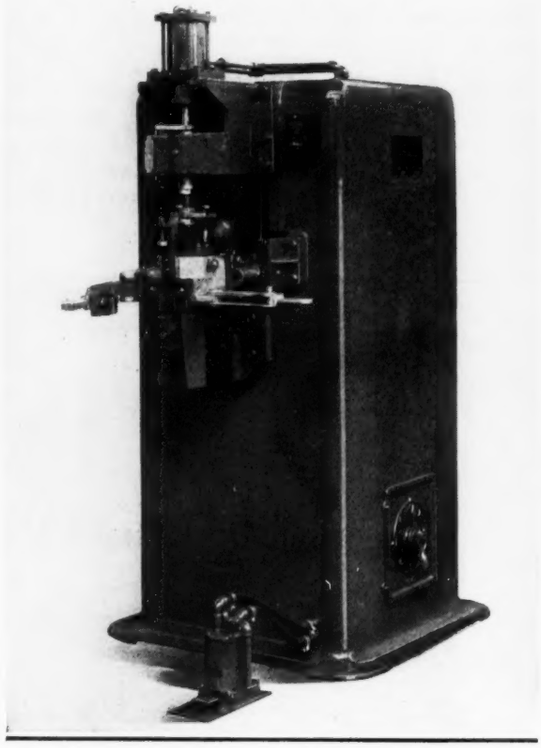
The machine has a dial which the operator moves to obtain easily the required timing for different jobs. Steel from No. 28 to 22 gage can be welded. The machine is used in conjunction with a General Electric Thyratron tube or a Westinghouse Ignitron tube.

Acetylene Generator for Soldering and Brazing

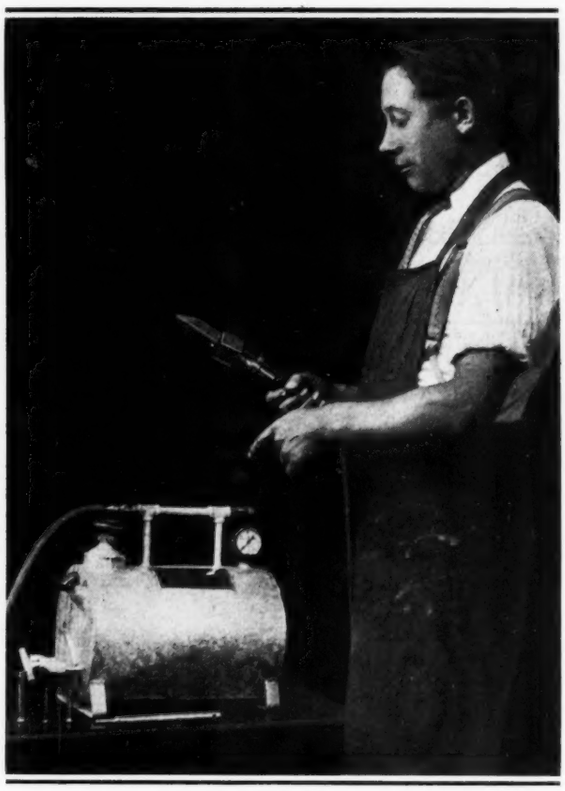
A compact unit designed for economical soldering and brazing in general industrial fields is being placed on the market by Reiner & Campbell, Inc., 242 Lafayette St., New York City. This unit, which is here shown, measures 13 inches in length by 10 inches in height. It weighs 35 pounds when charged.

Water is put in the unit up to the spout level, and carbide in a lower compartment. When the handwheel is then turned down, acetylene gas is generated automatically until the charge of carbide is used up. One charge of carbide (about 1 1/2 pounds) will last for approximately 4 hours of continuous soldering or light brazing. The water held by the unit is sufficient for three charges of carbide.

When the unit is not in use, the generation of gas is automatically stopped. The gener-



Federal Percussion Welder for Welding Handles to Saucepans



Acetylene Generator for Soldering, Brazing, and Blow-torch Work

ator can be recharged with carbide while in operation.

Soldering irons attached to the hose leading from the generator are heated in one or two minutes, and can be kept at any desired heat. A blowpipe can easily be attached and provided with various sized tips, from a needle-point tip to one giving a brush type flame.

Equipment for Forming and Finishing Sheet Metal

Equipment that provides an inexpensive method of crowning, forming, and finishing sheet metal, hot or cold, to suit limited production demands is being placed on the market by the Northill Co., Inc., 5728 Santa Monica Blvd., Los Angeles, Cal. Any desired crown or shape can be produced with this equipment by merely oscillating a roller across the work, the latter being supported on a forming table. Three table forms are provided, a spherically concave bowl, a flat plate, and a reverse-curve shape.

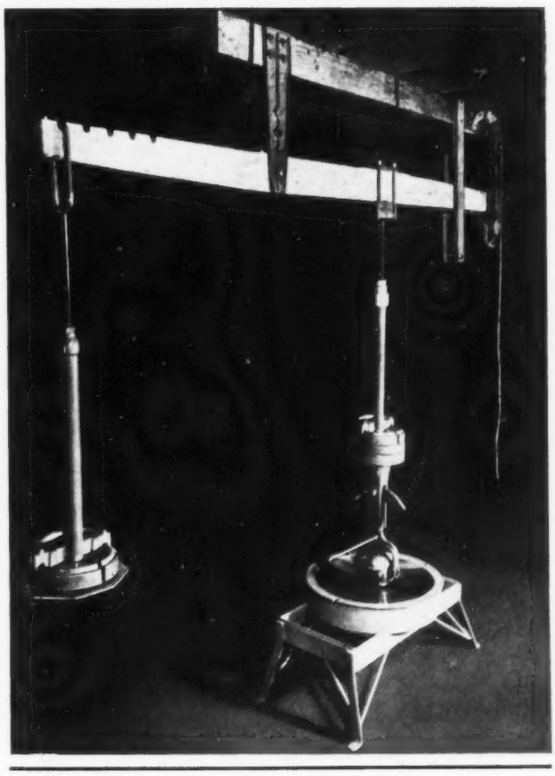
To obtain a deep crown, the sheet metal is stretched rapidly to the rough form by working the material on a felt pad. It is claimed to be impossible to tear or distort the metal or to destroy the original mill finish.

Michigan Steering-Gear Worm Lapping Machine

A lapping machine for finishing steering-gear worms has recently been designed by the Michigan Tool Co., Detroit, Mich. One of the important features of this machine is an automatic timing mechanism which is variable for each side of the thread. Thus the machine can be adjusted to suit worms which, as often happens, are produced consistently with a better finish on one side of the thread than on the other. Another important feature is that, because the center distance between the laps is adjustable, the laps can be recut and then used on the same type of worm-gear as before.

There are two lap spindles extending from the front of the machine, as may be seen in the illustration. Each of these is fitted with an adjustable hydraulic brake. The work runs on centers, thus eliminating the need for adapters and costly tooling.

Adjustment of the braking pressure provides a control on the lapping action, in addition to the control afforded through the setting of the time cycle. The cycle is controlled by means of automatic cut-out relays at the rear of the machine. After the operator starts the machine by depressing a push-button, the 3/4-horsepower motor drives the



Equipment Designed to Shape Sheet Metal Parts Required in Limited Quantities

Steering-gear Worm Lapping Machine which Operates on an Adjustable Automatic Cycle

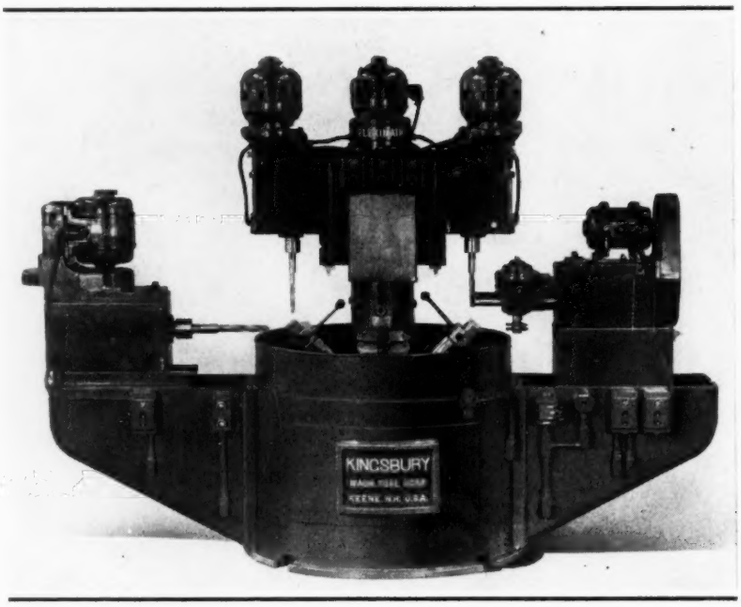
worm through a belt in one direction to lap one side of the worm thread for a period determined by the setting of one relay. The second relay then cuts in, cutting out the first and reversing the motor for lapping the opposite side of the thread. Both relays can be individually adjusted to provide lapping cycles of from 15 seconds to 5 minutes.

Kingsbury Fleximatic Drilling, Tapping, and Milling Machine

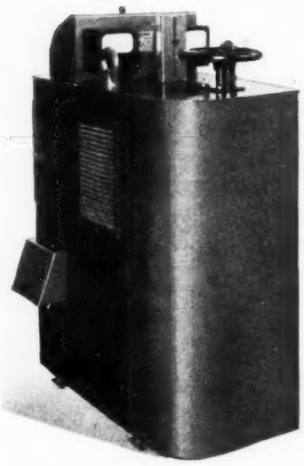
A center-column automatic indexing type machine developed to perform simultaneously drilling, milling, threading, and similar operations at a high rate of production has been announced by the Kingsbury Machine Tool Corporation, Keene, N. H. The various operations are performed by units, each of which has a self-contained drive and feed. These units can be readily located to suit different requirements, thus making the machine adaptable for handling a wide range of work.

The rotary table or turret is automatically indexed in from one to two seconds by a motor operating through worm and planetary gearing. The table is indexed slightly past its set position and then the motor is reversed to back the table against a registering pawl. The table is locked in position by the torque of the motor, the voltage then being greatly reduced by a transformer to avoid excessive heating. Because the table is indexed away from the registering pawl there is no sliding contact of the locating surfaces, and consequently no wear to impair their accuracy.

The drilling units are tripped electrically through special solenoids as the indexing motor reverses to lock the table in its set position. The table can be indexed only when all spindles are in their retracted positions. This machine can be furnished for 4, 5, 6, 7, 8 or more indexes of the table per revolution. Double indexing can be provided for if desired. The rotary table is 36 inches in diameter and has a finished surface for fixtures 32 inches in diameter.



Kingsbury Center-column Automatic Indexing Type Drilling, Tapping, and Milling Machine

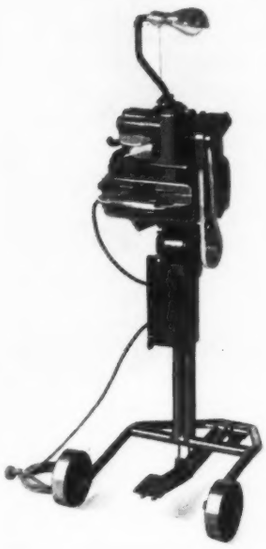


Westinghouse Transformer Type Alternating-current Welder of 500 Amperes Rating

Westinghouse Transformer Type Welders

A transformer type of alternating-current welder having a welding range of from 100 to 500 amperes will be a feature of the exhibit planned by the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., for the National Metal Exposition. This machine operates at a high efficiency and is equipped with an automatic control which cuts the machine off the line when the operator stops working. The machine is brought back on the line with a momentary contact made by means of a switch in the holder. This welder is intended to meet the need for relatively high current values in high-speed production work.

The same concern will also exhibit a 30- to 150-ampere alternating-current welder of the transformer type. This equipment is available for primary voltages of 110 to 220, and 220 to 240. The equipment weighs 230 pounds. This welder also is suitable for production work and for repair shop use. Another exhibit will be a 300-ampere "Flexarc" direct-current welder.



Eisler Equipment for Welding, Annealing, and Trimming Wire Cable

Eisler Welder and Trimmer for Wire and Cable

Flexible shafts, stranded wire and cables composed of a multiplicity of small wires, either twisted together or coiled helically, have a tendency to unravel at the ends upon being cut. This makes it difficult to join cut cable, for example, to other pieces of cable or to mechanical parts. To overcome this condition, the Eisler Engineering Co., 752 S. 13th St., Newark, N. J., has developed the combination cutting, welding, trimming, and annealing machine here shown.

A flexible shaft or cable to be cut apart is clamped in the welding jaws of this machine. The application of current welds the strands together and finally severs the cable. The ends of the cable can then be finished off by a grinding wheel in the trimmer unit, which is driven by a 1/20-horsepower motor.

For welding two ends of cable together, they are first prepared in the manner explained. Then the ends are welded, after which the cable is placed in the annealing device. After annealing, the cable is inserted in the automatic centering device of the trimmer and the burrs of the joint are ground off. The machine will also handle solid rods, wire, and bars. It can be mounted on a bench or on a movable pedestal as shown. The equipment is designed to operate on 110- or 220-volt alternating current.

Pratt & Whitney Camlock Serrated-Blade Reamers

Adjustable serrated-blade reamers of a new patented design are being placed on the market in both shell and shank types by the Pratt & Whitney Co., Hartford, Conn. These reamers are of an unusually heavy design. Two cams lock each blade in place, and hence the trade name "Camlock" has been adopted for the reamers. At the back end of each blade are two nuts which provide for easy adjustment to required diameters. A quarter turn of the adjusting nut forward increases the reamer diameter 0.0003 inch. When the correct size has been obtained, the blades are locked by a counter-clockwise turn of a cam. To decrease the size, the operation is reversed.

Serrations on one side of each blade fit into corresponding serrations in the reamer body. Alignment and positioning of the blades in the reamer body are maintained accurately due to the number of parallel bearing surfaces of the serrations and the large areas of contact.

The blades are pushed forward by means of the adjusting nut to increase the cutting diameter. This permits the reamers to function equally well in through holes, in blind holes, or against shoulders. When a considerable increase in size is required, the blades are slipped into other serrations in the body, each serration increasing the diameter 1/16 inch.

Only seven sizes of blades are required to cover the entire range of reamers from 1 1/4 to 6 inches, inclusive, while ten arbors are sufficient for the full set of shell reamers from 1 1/2 to 6 inches, inclusive. All reamers are regularly made with a left-hand spiral, but reamers with right-hand spirals can be supplied. The chucking reamers are made with either straight shanks or Morse taper shanks. Arbors are available for the shell reamers.

Camlock Serrated-blade Reamers of Shank and Shell Types, Recently Brought out by the Pratt & Whitney Co.

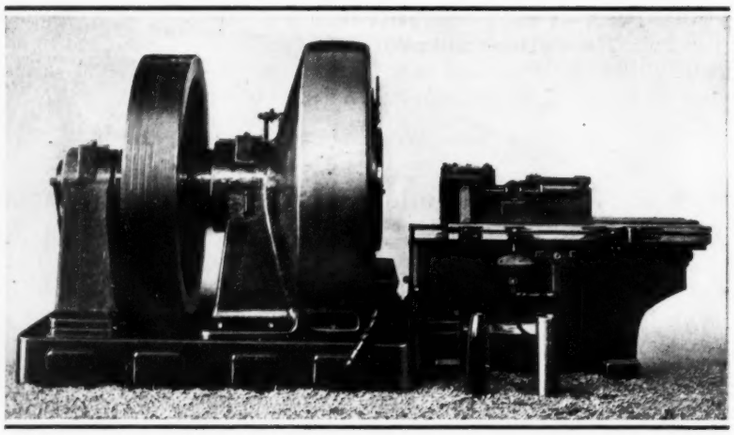


Fig. 1. Langelier Swaging Machine Capable of Handling Work Having a Finished Diameter as Large as 6 Inches

Langelier Swaging Machines

Work can be tapered or reduced to a finished diameter as large as 6 inches in a No. L swaging machine recently improved by the Langelier Mfg. Co., Providence, R. I. This machine is the largest of its type that has been built. The size of work that can be swaged depends on whether the material is solid or hollow, whether it is swaged cold or hot, and on the length of the required contour.

The machine illustrated in Fig. 1 was supplied to the Frankford Arsenal for swaging shells. The swaging head is designed on the fixed-roll principle, fourteen hardened and ground rolls being equally spaced in a ring around the head end of the spindle.

The work is fed into the dies by a hydraulically operated table. Adjustable dogs control the table working cycle, permitting a fast advance, a slow feed, a pause if required, and a rapid return. The work is gripped immediately after the start of the quick advance and released just before the table stops on its return. This machine weighs approximately 22 tons.

Fig. 2 shows one of three vertical machines redesigned by the same company for swaging tungsten wire used in electric light bulbs. The wire can be swaged either hot or cold. When it is to be swaged hot, a furnace can be attached to the front cover of the machine. A belt-driven roll feed is provided, different rates of feed being obtainable by changing pulleys. The swaging spindle runs in two roller bearings.

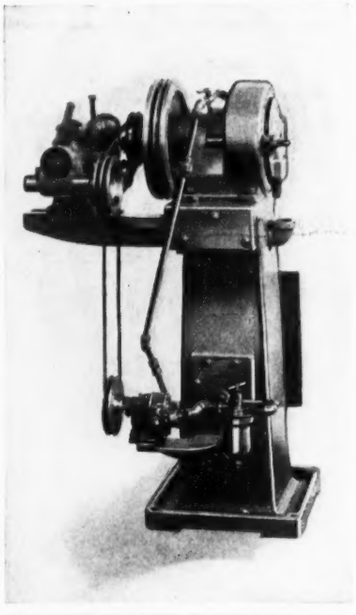


Fig. 2. Improved Machine for Swaging Tungsten Wire

Ettco-Emrick High-Speed Tapping Attachment

A tapping attachment for use on drilling and other machines at speeds up to 2000 revolutions per minute, has been introduced by the Ettco Tool Co., 596 Johnson Ave., Brooklyn, N. Y. The name Ettco-Emrick has been applied to this attachment to distinguish it from the Ettco attachments which were its predecessors. Two sizes are available, a No. 100 which has a capacity for 3/16-inch taps and a No. 200 which has a capacity for 1/4-inch taps. The reverse speed ratio is 1 3/4 to 1.

The drive is through sensitive cone friction clutches which are so proportioned that they will slip before breaking a tap, even when the tap bottoms in a blind hole. The entire mechanism is contained in an oil-tight case and runs in an oil bath, the oil being circulated by baffles with a centrifugal pumping action.

The cone clutches have oil- and wear-proof asbestos-carbon friction surfaces which maintain their coefficient of friction when running in oil. Helical gears with compound reversing idlers which balance the thrust are employed. Ball bearings are provided for the driving and reverse clutch shells. Several different styles of cases are furnished with means for attaching portable drills, electric motors, special machines, etc.

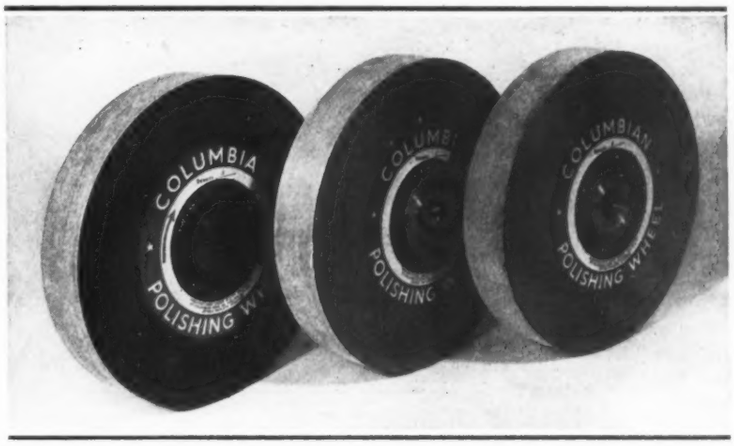
High-speed Tapping Attachment Made by the Ettco Tool Co.

Columbian Fiber Polishing Wheel

The Carborundum Co., Niagara Falls, N. Y., and the Divine Bros. Co., Utica, N. Y., are exclusive distributors for a new type of polishing wheel which is recommended for use in connection with Aloxite Brand TP and Carborundum polishing grain for all classes of metal and glass finishing.

This polishing wheel is made by combining the strongest known vegetable fiber with a fine scientifically controlled resilient bonding agent. The result is a wheel of even density and texture throughout. It has no hard or soft spots and no ridges, and it presents an unusually resilient cushion to the work. The wheel will maintain its face either flat or formed and will hold its abrasive head for an unusually long time. It is smooth running, fast cutting, held to close limits of balance, and stays in balance. Old abrasive heads can be easily removed.

This polishing wheel is made in three densities or grades of hardness — soft, medium, and hard. This enables the selection of the proper grade of wheel for the work to be done. The wheel is set up with glue and abrasive in the conventional manner. Water, oil, or grease have no deteriorating effect on the materials which form the wheel structure. Special faces can be furnished on the wheel for polishing and finishing formed parts. An accurately machined hub built into the wheel eliminates excessive wear or scoring that might be caused by frequent wheel changes and provides for smooth running.



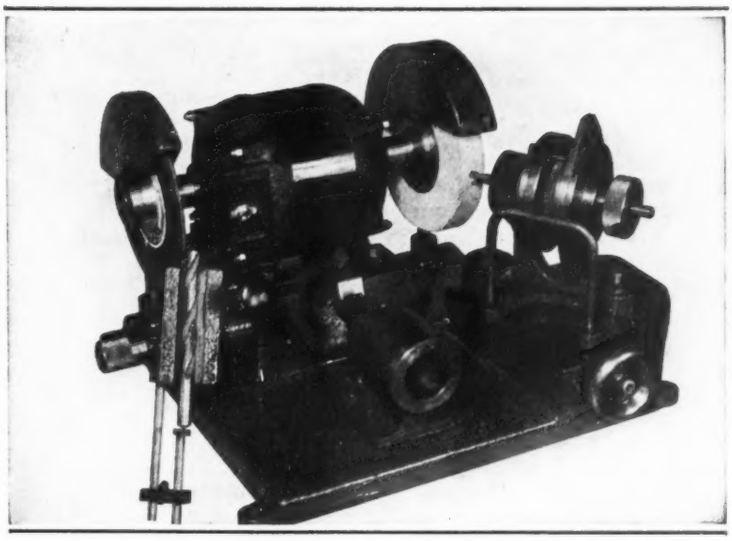
The Columbian Polishing Wheel is Made in Soft, Medium, and Hard Grades

The wheel is recommended for metal finishing operations such as performed with hard canvas, felt, and various types of compressed polishing mediums.

Wells Drill-Sharpening Machine

An 18D drill sharpener, with a capacity for sharpening two-lip right-hand twist drills from 1/4 to 1 inch in diameter, inclusive, has been brought out by the Wells Mfg. Co., Greenfield, Mass. This machine can be adjusted to grind any point angle required and any relief angle from 6 to 12 degrees, inclusive. Special equipment is also available for use in grinding left-hand twist drills and for one-, three- or four-lip right- or left-hand drills. The machine is equipped with a 1/3-horsepower, 110-volt, single-phase motor having a speed of 3400 revolutions per minute.

A fixture of simple design is employed for setting the drill to be ground. The machine is designed to insure grinding both cutting edges of the drill to the same length and to the same angle with the center line. It also gives identical relief angles at the periphery of both lips, with the angle increasing toward the center of the drill. Provision is made for thinning the web and for removing the corners at the periphery of the drill. It is claimed that the latter operation as performed on this machine will greatly increase the life of the drill.

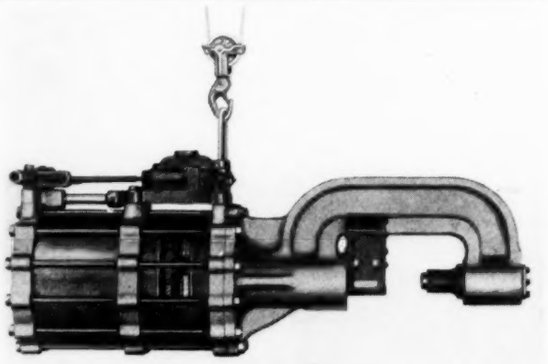


Drill-sharpening Machine Developed by the Wells Mfg. Co.

Hanna Portable Pneumatic Press

Portable air-operated equipment, which is designed primarily for pressing spring-shackle bushings and pins into automobile chassis frames, but is also finding general application in other pressing operations, and is suitable, as well, for punching, riveting, upsetting, and marking, has recently been developed by the Hanna Engineering Works, 1765 Elston Ave., Chicago, Ill.

This type of press is shown in the illustration tooled for pressing shackle bushings into chassis frames. As a hopper feed is provided for the bushings, the operator need only locate an index-pin in the chassis frame and operate a valve trigger to drive the bushing into place with a predetermined pressure. There is no need of starting the pin or bushing in the hole prior to applying pressure.



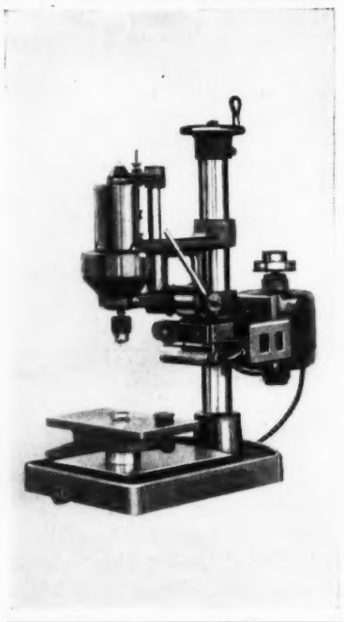
Hanna Portable Equipment for Pressing, Punching, Riveting, Upsetting, and Marking Operations

Two cylinders separated by a diaphragm make this an unusually compact unit and effect a saving in air consumption. Aluminum alloy castings are used in the construction of this equipment, with the result that the weight is only 135 pounds. This pneumatic press is available in capacities of 3, 4, and 5 tons. Yokes of different reaches and gaps can be supplied.

Direct-Reading Brinell Machine

A hardness testing machine of the power-driven direct-reading Brinell type has recently been introduced by the Detroit Testing Machine Co., 5137 Trumbull Ave., Detroit, Mich. This machine is made in two sizes with work gaps 6 by 12 inches and 9 by 18 inches. Testing is done on rough surfaces without spotting.

Tolerance hands on the face of an indicating dial are set to the desired limits, after which the operator merely notes that the pointer stops within these limits. This permits Brinell testing operations to keep pace with other production work. Tests made by the machine may be checked with a microscope at any time to eliminate all possibility of error. This also permits the use of the machine in the conven-



Bench Drilling Machine which can be Run at Speeds up to 8000 R.P.M.

Langelier High-Speed Bench Drilling Machine

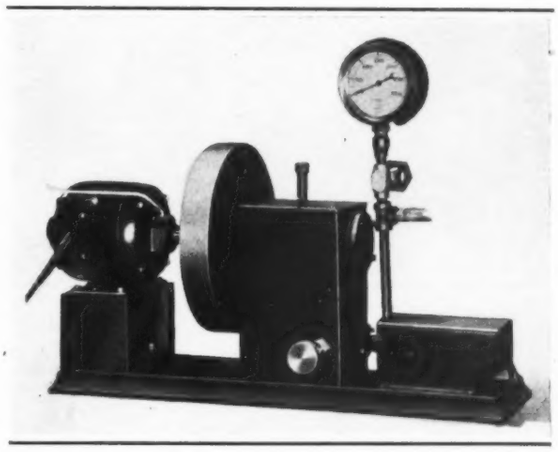
A high-speed super-sensitive bench drilling machine recently added to the line of the Langelier Mfg. Co., Providence, R. I., is similar to the A type built by the same concern, except that there is a deeper gap from the chuck to the column. Also, there is a new sub-table which can be swiveled and clamped in any circular position or removed from the machine to permit work to be drilled while standing on the base. An arrangement for adjusting the belt tension is another new provision.

Speeds from 2000 to 8000 revolutions per minute can be furnished through the provision of a suitable motor. The machine has a capacity for drilling 1/4 inch in steel. Mounted directly in back of the chuck is an electric light bulb enclosed in a casing which has a narrow opening that can be adjusted to focus the light beam on the end of the drill.

Brinell Hardness Testing Machine Introduced by the Detroit Testing Machine Co.

tional manner on odd specimens. A foot-pedal control leaves both hands free for handling the work. The direct-reading device works equally well on flat, round, or odd shapes.

This machine is also available in a plain motor-driven type without the direct-reading feature.



Four-piston Motor-driven Hydraulic Pump Made by the Hydro-Motive Co.

Hydro-Motive Hydraulic Pump

A hydraulic pump equipped with a flywheel on a crankshaft has recently been developed by the Hydro-Motive Co., 1001 W. Washington Blvd., Chicago, Ill. The crankshaft reciprocates four pistons spaced 90 degrees apart and two spool valves located 180 degrees apart. These pistons and valves are sealed by rings. A direct-connected motor drives the crankshaft and flywheel. Through the provision of the flywheel, it is claimed that hydraulic cylinders can be operated at the same speeds as crank presses.

The pump illustrated has pistons 3/4 inch in diameter and a stroke of 3/4 inch. It has a capacity of 5.6 gallons per minute, a maximum working pressure of 5000 pounds, and is driven by a 1/3-horsepower motor.

Shaw-Box "Grip Lifter"

A device designed for the safe handling of steel plates, columns, piling, or fabricated material has recently been developed by the Shaw-Box Crane & Hoist Co., Inc., Muskegon, Mich. This "Grip Lifter," as the device is called, is attached to a crane or hoist by a cable connection through the eye at the upper end. The lever on the left-hand side is pulled downward to lift sliding bars and a roller on the inclined surface, so that the full opening in the throat of the device can be placed over the marginal edge of the plate or other material to be handled.

When this lever is released, the load is held with a grip that cannot be broken until the load has been carried to the desired place, the lever pulled down, and the crane hook raised. The Grip Lifter cannot be released by pulling on the lever when the load is suspended in the air, because the pull on the lever must exceed the weight of the suspended load. This device is made in two sizes, one with a 5/8-inch throat and a capacity of 5 tons, and the other with a 1 1/2-inch throat and a capacity of 10 tons.

Device Designed for Safe Handling of Work by Cranes

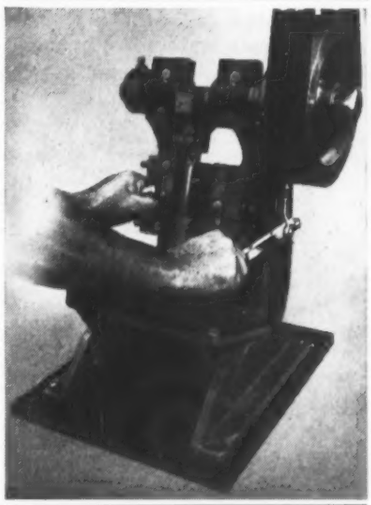
Rousselle Safety Device for Punch Presses

Practically all sizes and makes of hand-operated punch presses can be equipped with a safety device being introduced on the market by the David J. Ross Co., Benton Harbor, Mich. This Rousselle safety device consists simply of a bar, a one-piece housing, an operating lever, and a spring.

When the operator trips the press with his right hand, he must also touch the safety lever with his left hand. Both hands are therefore in use and out of danger every time that the press is tripped. The safety device springs back into place instantly when released, and locks the punch lever securely. The device cannot be put out of action, tied down, or easily taken off the machine to which it is applied. It is claimed that the device can be installed on a press within a half hour.

Skilsaw Electric Drills

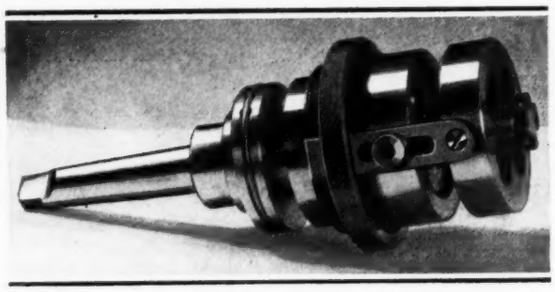
Two portable electric drills of 3/16- and 1/4-inch capacities, respectively, designed particularly



Rousselle Safety Device for Hand-operated Punch Presses

for assembly-line work in the airplane, automobile, radio, and refrigerator fields, have been added to the line of Skilsaw, Inc., 3310 Elston Ave., Chicago, Ill. Both of these drills are compact and light in weight. They measure only 7 1/2 inches long by 3 3/16 inches in diameter. They are available in speeds of 2000, 2500, 3000, and 3700 revolutions per minute.

Three heavy-duty ball-bearing electric drills with drilling capacities of 5/8, 3/4, and 7/8 inch have also been added to this company's line. These drills are intended for heavy drilling and reaming operations. They have two bearings on the armature, two bearings on the intermediate gear, and three bearings on the spindle. A three-jaw geared chuck is furnished on the 5/8- and 3/4-inch models, while the 7/8-inch model is equipped with a No. 2 Morse taper socket.



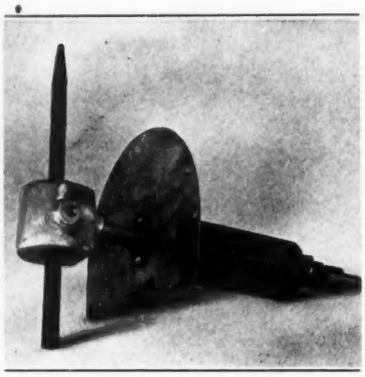
Rickert-Shafer Collapsible Tap with Adjustable Trip-ring

Collapsible Tap with Micro Adjustment

A Model BR collapsible tap equipped with a micro-adjustable trip-ring is being placed on the market by the Rickert-Shafer Co., Erie, Pa. The trip-ring support is slotted to engage the knurled ring. The body of the tap is threaded so that the slotted bars can be moved backward or forward by turning the knurled ring. This permits adjusting the trip-ring, which can be locked in place by means of two hollow-head screws. The construction saves considerable time in making accurate trip-ring adjustments.

Colmonoy Electrode Holder

An electrode holder designed for general carbon-arc welding and cutting is being placed on the market by Colmonoy Inc., P. O. Box 977, Los Nietos, Calif. This holder is furnished complete with adapters to fit 3/8-, 1/2-, and 5/8-inch diameter carbon sticks. It has a hollow fiber handle which slides back to cover water connections, a copper shield, and a water-cooled aluminum head. The head is equipped with brass piping through the handle for joining the water connection with the head. The feature of this electrode holder is that it remains cold even though the welder stays close to the work.



Electrode Holder for General Carbon-arc Welding

Welding Cable Designed for Wear Resistance

A welding cable designed to meet conditions of extremely severe wear and abrasion is being introduced to the trade by the Lincoln Electric Co., Cleveland, Ohio. This new cable, which is known as "Realwear," supplements the Stable-Arc electrode cable and ground cable made by the concern.

The new cable consists of fine tinned copper wire laid in ropes and stranded. Individual ropes are alternated in succession as regards the direction of the lay so as to prevent distortion under severe usage. The conductor is insulated with rubber compound to provide firm adhesion between the cover and the rubber insulation. High-grade cotton woven on a loom and joined to the rubber belt by a special process forms the cover. The cover is provided with a finish that is unusually resistant to oil, grease, acid, gasoline, moisture, and heat. The strength of the new cable is said to be comparable to that of fire hose.

"Ful-Vue" Safety Goggle

Comfort and appearance are the principal advantages mentioned for a new goggle brought out by the American Optical Co., Southbridge, Mass., which looks exactly like the "Ful-Vue" spectacles made by the same concern. Instead of the customary nose-piece, this goggle is provided with pearl full-rocking nose pads that distribute the slight weight of the goggle on the sides of the nose rather than on top. The ear-pieces are set high on the rims to give full side vision.

The lenses with which the gog-

"Ful-Vue" Safety Goggle that Looks Like Spectacles

gle is fitted are claimed to be capable of withstanding approximately twice as heavy blows as those that fracture standard lenses.

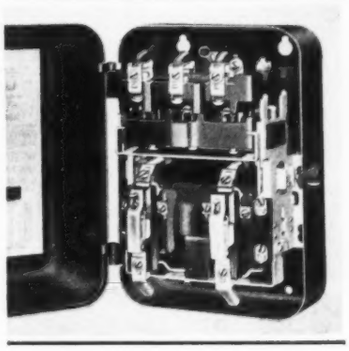
"No-Mar" Wrench for Hexagonal Fittings

The Greenfield Tap & Die Corporation, Greenfield, Mass., has brought out a new type of pipe wrench for use on hexagonal fittings. This wrench is provided with four-bearing "No-Mar" jaws that take hold with a non-slip grip which obviates crushing or marring the fittings. Because of this feature, the wrench is especially suitable for use on chromium-plated, nickel-plated, or brass valves, fittings, unions, and bonnets. The wrench is made in 8-, 10-, 14-, 18-, 24-, and 36-inch sizes.

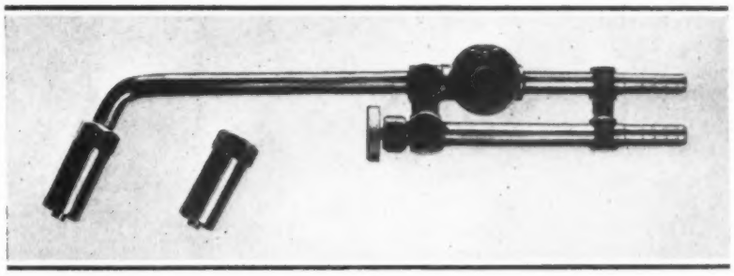
Condit Across-the-Line Motor Starter

A temperature-overload relay designed on the melting alloy principle is one of the features of an across-the-line motor starter recently brought out for general-purpose installations by the Condit Electrical Mfg. Corporation, Hyde Park Station, Boston, Mass. Greater accuracy is claimed to be obtained in this overload relay by completely enclosing it in a molded case.

This starter, which is designated Type A-32, is rated 25 horsepower at 440 and 550 volts, 15 horsepower at 220 volts and 7 1/2 horsepower at 110 volts. It is supplied for a push-button remote control. Other features of the starter are extra heavy silver contacts, a vertical make-and-break short-stroke mechanism, and a multi-break arc prevention device. There is also protection against under-voltage.



Condit Motor Starter with New Temperature-overload Relay



Torit Air-gas Torch of Improved Design

Bristol Wide-Strip Pyrometer

A wide-strip pyrometer in single-record, multiple-record, and recorder-controller types has recently been added to the line of industrial instruments manufactured by the Bristol Co., Waterbury, Conn. This instrument operates on the potentiometer principle, and is claimed to be unusually accurate due to a simple measuring, balancing, and recording mechanism.

A stainless-steel lead-screw, operated by an electric motor under the direction of two galvanometer-controlled contacts, adjusts the slide-wire contact and recording-pen unit to maintain electromotive-force balance in the potentiometer system. This mechanism introduces a new principle of operation into temperature measurement by means of the potentiometer method.

All mechanical backlash is taken up by the balancing mechanism, making it possible to magnify scarcely perceptible deflections of the galvanometer pointer. It is mentioned that deflections smaller than 0.001 inch are easily measured. Records are made on a chart 12 1/4 inches wide.

Torit Improved Air-Gas Torch

A No. 26 torch which may be used with various kinds of gases, such as natural gas, manufactured city gas, butane, propane, etc., in connection with compressed air, has been brought out by the Torit Mfg. Co., 174 W. Kellogg Blvd., St. Paul, Minn. This torch is especially adapted for use in shops and plants located where natural gas is replacing or will replace manufactured city gas. It is leak-proof and designed to insure thorough mixing of the gas and air. The torch is regularly supplied with two tips.

Link-Belt Motorized Variable-Speed Transmission

The Link-Belt Co., 910 S. Michigan Ave., Chicago, Ill., announces that the entire line of P. I. V. gear variable-speed transmissions can now be motorized when desired by providing a motor that

Link-Belt Motorized Variable-speed Transmission

forms an integral part of the units. The transmissions can also be supplied with or without speed reduction gearing, and with either a horizontal or a vertical box. While the transmissions were previously available in sizes up to 10 horsepower only, they are now made in five sizes up to 15 horsepower capacity.

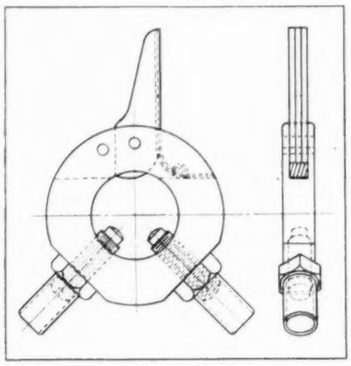
The motorized construction provides a compact drive and eliminates the need of a separate motor baseplate. The operating principle of the basic unit is the same as when it was introduced six years ago. It constitutes an all-metal automatically lubricated device which employs a side-contact chain between adjustable-diameter wheels having radially cut teeth for transmitting power positively from the input shaft to the output shaft.

Air-line Coupling of Quick Connecting and Disconnecting Type

Schrader Quick-Acting Couplers for Air Lines

Couplers designed for attaching grease guns, spray guns, air chucks, chuck gages, etc., to air lines in as brief a time as it takes to plug into an electric socket have been placed on the market by A. Schrader's Son Division of Scovill Mfg. Co., 470 Vanderbilt Ave., Brooklyn, N. Y. The coupler can be disconnected as quickly as it is connected.

These couplers are made of steel and are cadmium-plated. The working parts consist of a tripping deflator and a rubber washer which is replaceable when worn. The couplers are airtight and permit a free flow of air in operation. They are available in swiveling and stationary types.



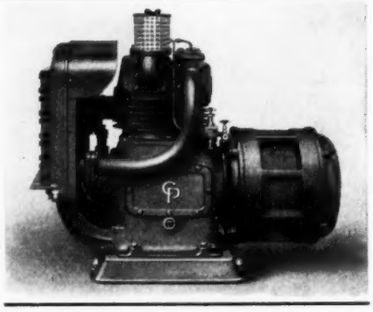
Quick-acting Grinder Dog Made by the Ready Tool Co.

Work-Driving Dog for Cylindrical Grinders

The work-driving dog shown in the accompanying illustration is being placed on the market by the Ready Tool Co., 550 Iranistan Ave., Bridgeport, Conn. It can be used on any cylindrical grinder and is particularly adapted for use when the actual grinding time is short. The dog is of the cam type. It is designed to eliminate slipping and to permit application or removal with one hand.

Chicago Pneumatic Two-Stage Air-Cooled Compressors

A complete new line of air compressors in which many refinements and improvements have been incorporated is announced by the Chicago Pneumatic Tool Co., 6 E. 44th St., New York City.

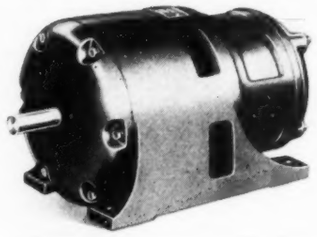


Chicago Pneumatic Compressor with Built-in Motor

These compressors are regularly made in four models having capacities ranging from 85 cubic feet per minute up to 323 cubic feet per minute. They may be obtained in a built-in motor type, coupled type, or for V-belt drives.

Sier-Bath Plain and Motorized Speed Reducers

A line of speed reducers, built in both plain and motorized types, has been brought out by the Sier-Bath Gear Co., 640 W. 58th St., New York City, to supplement their regular line of gyrating speed reducers. The new units will be built in all sizes from 1/2 to 10 horsepower and in ratios from 10 to 1 up



Sier-Bath Speed Reducer of Motorized Design

to 42 to 1. They are especially intended for the lower ranges of speed reduction, while the gyrating units are intended for the higher reduction ranges.

These units have double-reduction helical gears and are designed to be fitted with standard N.E.M.A. motors. The alloy steel heat-treated helical gears are supported on extra heavy ball bearings throughout. It is stated that these units will carry 150 per cent momentary overload.

Stop-Off Lacquer for Use in Chromium Plating

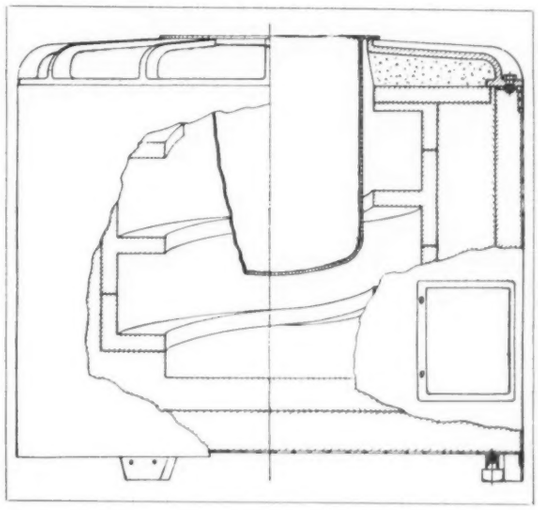
A lacquer known as "Unichrome Resist" has been developed by United Chromium, Inc., 51 E. 42nd St., New York City,

for use when chromium plating is to be confined to certain surfaces of parts. This new stop-off lacquer is quickly applied either by brushing, spraying, or dipping. It is an unusually good insulator from the electrical standpoint. The lacquer is resistant to the chemical action of the acids and rinse waters employed in cleaning and plating operations. It flows readily, air-dries quickly, and has good adhesive properties.

The lacquer is readily removable by means of a solvent. When in contact with the chromium-plating solution, it does not contaminate the solution. Another advantage of the lacquer is that it is non-toxic.

Columbium-Treated Stainless-Steel Welding Rod

A columbium-treated 18-8 stainless-steel welding rod, known as Oxweld No. 28, has just been announced by the Linde Air Products Co., 30 E. 42nd St., New York City, for welding chrome-nickel steels of the 18-8 type. This welding rod has been developed to simplify the fabrication of products made from 18-8 stainless steel and to improve the corrosion resistance of the fabricated joint areas. An outstanding feature of this new rod is the inclusion of a definite quantity of the element columbium. Products fabricated from treated or stabilized 18-8 steel by welding with this new rod are claimed to have full corrosion resistance and heat resistance in the "as welded" condition, no heat-treatment being required after welding.

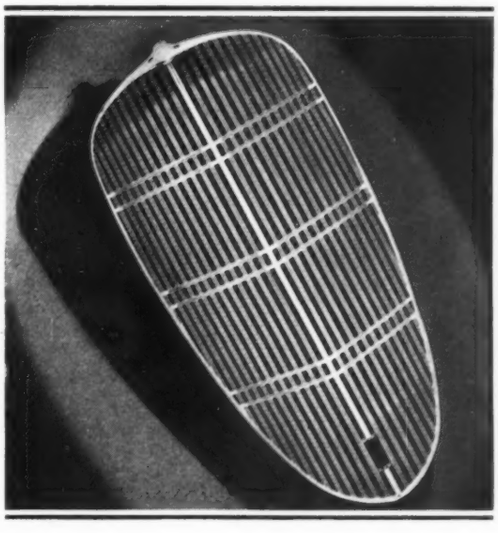


Construction of the Lindberg Screw Type Pot Furnace

Lindberg Screw Type Pot Furnace

The combustion chamber of a pot furnace recently designed by the Lindberg Engineering Co., 224 Union Park Court, Chicago, Ill., is constructed in the shape of an internal screw, as illustrated. With this construction, the gases of combustion are forced to pass around the pot two and a half times before they leave the heating chamber, whereas in the usual pot furnace the flame travels once around the pot and leaves at the flue. An advantage claimed for the screw type of furnace is that the gases have sufficient opportunity for complete combustion before they leave the furnace.

The burner fires entirely below the pot, thus eliminating flame impingement and providing a uniform ribbon of flame on all sides of the furnace from top to bottom. Increased efficiency is claimed for the furnace in such operations as cyanide hardening, lead hardening, and soft-metal melting. In addition to savings in heating from cold and during operation, production is increased.



The Radiator Grille of "Oldsmobiles" is Representative of the Advanced Stage of Die-casting Practice. This Grille is a One-piece Zinc Casting that is Approximately 34 Inches Long by 17 Inches Wide. It Comes to a Vee in the Center, the Height of the Vee Being 6 1/2 Inches. The Weight is 17 Pounds. The Size of the Casting and the Intricacy of its Design Presented a Considerable Problem for the Die Designer. The Illustration Shows a Grille After the Chromium-plating Operation. Photo Courtesy of New Jersey Zinc Co.

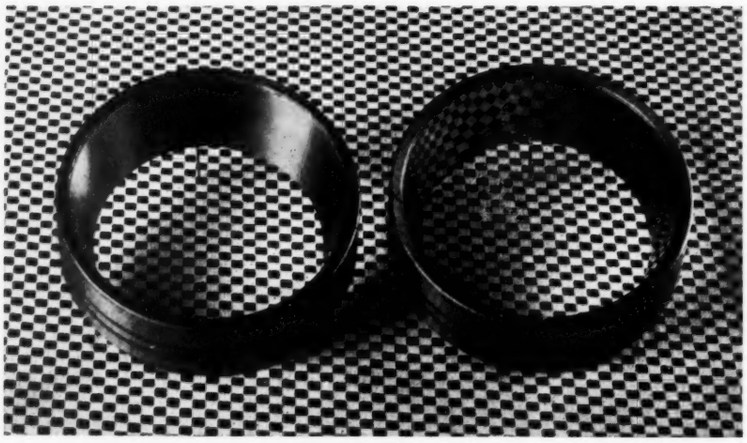


Fig. 1. Illustration made from Unretouched Photograph of a Regular Ground Cup and a Mirror Finish Cup. Note How the Mirror Finish Cup on the Right Reflects the Checkered Background

Measuring the Finish on Timken Bearings

As fast as special equipment can be built and installed, the Timken Roller Bearing Co., Canton, Ohio, will provide its bearings with what the company terms a "mirror finish." While the standard finish of the past has been so smooth that the eye and finger-nail test could hardly determine any irregularities in the ground surface, this new finish is much smoother. At *A* in Fig. 2 is shown a regular or standard finished surface and at *B*, a mirror finish, both magnified five hundred times in a vertical plane to emphasize the slightest irregularities.

To achieve this uniformity of finish, several years of experimental work have been required and a method of measuring surface finish was needed. Early in 1933, Dr. E. J. Abbott, research physicist at the University of Michigan, presented a paper before the annual meeting of the Society of Automotive Engineers in Detroit on "Surface Finish and How It Can be Measured and Specified." The work described in this paper was done in connection with Timken research at the University of Michigan, and the instrument developed by Dr. Abbott for measuring surface finish, called the "Profilograph," was immediately put to work at the Timken plant.

At *C* are shown profilograms of surfaces in their true proportions, magnified one thousand times. Line *a* shows a rough-honed finish; line *b*, a single feed mark of a diamond bore; and line *c*, the finish secured by finish-honing. By comparing *A* and *B* with *C*, a striking example of the extent to which finish can be perfected will be noted.

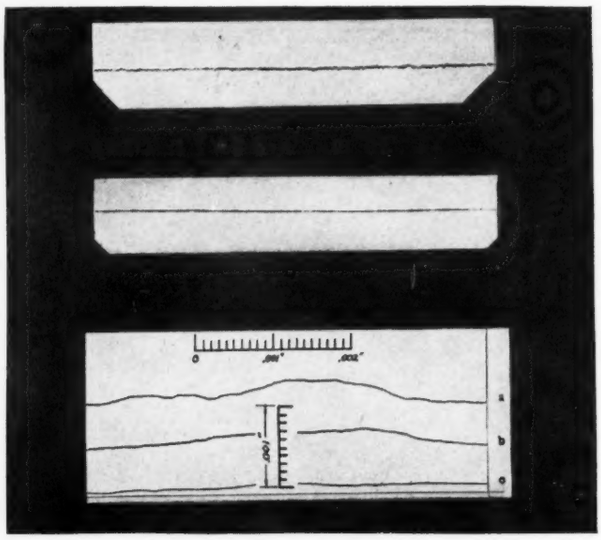


Fig. 2. Comparison of Different Surface Finishes as Indicated by the Profilograph

* * *

Indications of Sustained Business Improvement

The marked improvement in the machine tool industry is an accurate indication of the improvement that has taken place throughout the entire machine-building and metal-working industries. The last few months have represented what might well be termed a normal business in the machine tool industry, and the Machine Tool Show, held in Cleveland during September, greatly stimulated further interest in improved equipment. In fact, thousands of the visiting mechanical executives realized how out of date some of the equipment used in their plants really is and how difficult it is for them to hold their own in a highly competitive market with machines that are not capable of the output of the newer types. It is quite certain that a great deal of business will be placed as a direct outcome of the Show.

The General Motors Corporation is prepared to spend something like $50,000,000 on plant improvement, most of it for new shop equipment, during the coming twelve months. The average age of the automobiles on the roads of the United States has never been as high as it is at the present time, and with the return of better business conditions, there is a tremendous amount of car buying ahead. The automobile companies are preparing for this event.

A $10,000,000 project to provide the Ford Motor Co. with new hot strip steel rolling mills and sheet steel cold finishing mills is now under way. The building program, involving an outlay of $650,000, has been completed, and the new machinery installed is just ready for operation. The new mills will make it possible for the Ford Motor Co. to produce sufficient steel for the building of 3000 cars a day. The steel mill project is only part of a $20,000,000 expansion program which is being rushed to completion at the Rouge Plant this year. The capacity of the main power house will be increased from 220,000 to 330,000 horsepower.

The Automobile Manufacturers' Association, 366 Madison Ave., New York City, announces that the output of cars and trucks of the members of the Association (which includes every important manufacturer except the Ford Motor Co.) for the first eight months of the year was 20 per cent above the corresponding period last year and very close to the two million mark. The production is steadily holding above that of last year. The August output was 7 per cent over August, 1934.

Present Status of Cemented-Carbide Cutting Tools

At the meeting of the Machine Shop Practice Division of the American Society of Mechanical Engineers, held in Cleveland in conjunction with the National Machine Tool Exposition, the Sub-committee on Metal Cutting Materials presented a progress report covering the present status of cemented carbide and other modern cutting materials, prepared by Roger D. Prosser of Thomas Prosser & Son, New York City.

This report, published by the American Society of Mechanical Engineers, 29 W. 39th St., New York City, is a most complete review of the new cutting materials. It deals first with the extent of the application of cemented-carbide tools, cobalt high-speed steel, and Stellite. It lists the types of operations for which these cutting materials are used and then specifically reviews the types of materials on which the cemented carbides are used successfully, the economies shown by the use of cemented carbides, the grinding of tools made from this material, cutting speeds, and chip disposal. Considerable attention is given to the machine equipment required for obtaining proper results with cemented-carbide materials. The effect of the price of cemented-carbide materials on their more general use is also discussed. The report gives the following summary of its contents:

"The survey shows that a very large percentage of users of cutting tools are employing cemented carbide, and that those who can use it at all are doing so in constantly increasing quantities. Other modern cutting-tool materials, especially the latest types of high-speed steel, are going ahead rapidly, and progressive shops are employing an average of nearly 50 per cent of cobalt high-speed steel, cemented carbide, and Stellite, combined. Evidently the manufacturers have 'seen the handwriting on the wall,' and realize the necessity of using the best possible cutting tools to keep their machines operating at maximum efficiency, and to enable them to meet the tightening competition on every hand.

"The recent development of new types of cemented carbides for use in machining steel has resulted in their greatly increased use for this purpose. The field of use is constantly widening, great savings being made through the use of milling cutters, counterbores, reamers, spot facers and end-mills, gages, wear resisting parts, etc., fitted with cemented carbide.

"Two questions seem to be uppermost in the minds of users at this time; first, that of price; second, that of the need for machine tool equipment to utilize cemented-carbide tools to their full capacity.

"As far as price is concerned it is the writer's opinion that a substantial reduction in the price of the larger size pieces would result in increased use of cemented-carbide tools and would assist in the development of the art.

"In connection with machine tool equipment it was the majority opinion that although cemented-carbide tools are being used to great advantage on many existing machines, new machine tools should be purchased to replace obsolete equipment and take full advantage of these modern cutting metals as soon as economic conditions warrant. Further developments in machine tools are also indicated, especially for machining of steel, where maximum stresses are encountered, calling for machines having the utmost rigidity, power, and speed, developed especially for use with cemented-carbide cutting tools.

"The average length of time required for grinding the tools indicated that much time is lost in this operation, and showed the need for proper grinding equipment, at a reasonable price, to permit rapid grinding to keen edges, held to correct angles, with as little wastage as possible.

"It was noteworthy that practically no failures were reported in the replies to the present questionnaire, although there were a number in the first two surveys, indicating a greatly improved grasp of the technique involved in the use of cemented carbide. However, it appeared that many users are not obtaining much more than one-half of the benefits possible with their cemented-carbide tools, even when using their present machine tool equipment. Apparently it is the same old story all over again; some shops seem to be slowly and painfully absorbing the necessary information through bitter experience, instead of having one man in charge whose business it is to know the possibilities of the tools and how to handle and grind them. The need for a definite plan for obtaining the most efficient results from all cutting tools in the plant is strikingly apparent. In the opinion of the writer, such a plan should embrace the following:

"(1) Appointment and proper training of one man to be in charge of all cemented-carbide tools in the shop; this man to be responsible for setting the speeds and feeds, grinding of the tools, making sure that the machine tool equipment is kept in best possible condition, making recommendations as to new equipment needed, being answerable for the performance of the tools in general, and for the net results obtained.

"(2) Speeds and feeds to be set so as to obtain the benefit of the maximum possible performance of the tools.

"(3) Installation, if not already available, of suitable simple grinding equipment which will produce a fine cutting edge, held to the correct angles, in the minimum possible time.

"(4) Designation of certain definite men to grind all cemented-carbide tools, and instruction of these men in the proper procedure, instead of allowing each operator to grind his own tools.

"With such a plan, the maximum savings possible with cemented-carbide or any other tools will be obtained."

* * *

Metal Products Exhibit in New York

On September 16, the first section of a permanent Metal Products Exhibit was opened in the International Building, Rockefeller Center, New York City. Metals and other materials styled in the modern manner for both technical and consumer products will be featured in a joint exhibition by a group of well-known industrial designers.

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The Machinery Division of the Bureau of Foreign and Domestic Commerce, Washington, D. C., has prepared a list of purchasing offices of the Federal Government, which is available free of charge. The list should be of value to those selling machinery, equipment, or supplies to the Federal Government.

MACHINERY Brings Out a New Series of Small Books

MACHINERY'S YELLOW-BACK SERIES. 50 small books by various specialists in engineering and manufacturing practice (see following list of titles). 14 to 22 pages, 5 1/2 by 8 1/2 inches. Published by MACHINERY, 148 Lafayette St., New York City. Price, 15 cents each; 8 for $1.

This new series of single-subject booklets has been published to meet the demand for small inexpensive treatises giving in condensed form the essential facts about a carefully selected list of important mechanical subjects. These books, with few exceptions, contain matter not found in other publications. They are specific in character and give facts likely to be of the greatest practical value.

To illustrate the single-subject feature and the definite character of these books, take the one on arc welding as an example — No. 240. This book deals with the design and character of the weld itself, whereas another—No. 241—gives practical pointers on welding methods, and No. 243 focusses on the arc welding of jigs and fixtures. Book No. 208 deals specifically with the lubrication of ball and roller bearings and is based on extensive tests. Book No. 203 features high-speed steel hardening, and it is written by a specialist who has placed on record his experience of fifteen years devoted exclusively to investigation of steel hardening troubles in many different plants. Every book in the series is of the same definite character and gives condensed information focussing on a single subject.

A glance at the following list of titles and sub-titles will give the reader at least a general idea of the character and scope of the various other books in this Yellow-Back Series.

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203—HIGH-SPEED STEEL HARDENING HINTS—Methods that Have Given Best Results.

204—TOOL STEELS—Kinds to Use for Different Tools.

205—GEAR STEELS—Selecting to Suit Industrial Gearing and Automotive Drives.

206—STAINLESS STEEL—Composition, Strength, Applications, Machining, Drawing, and Polishing.

207—SELECTING THE RIGHT LUBRICANT — Properties of Oils, Grease Lubricants.

208—LUBRICATION OF BALL AND ROLLER BEARINGS — Results of Extensive Tests.

209—TAPERED ROLLER BEARINGS —Mounting to Suit Operating Conditions.

210—EXPANSION FITS—Use of Dry Ice in the Machine Shop.

211—CUTTING OFF STOCK—Thin Abrasive Wheel Method of Cutting Different Materials.

212—PLASTIC MATERIALS — Physical Properties and Applications of Different Types.

213—HOW TO MOLD PLASTIC MATERIALS—Molds and Presses of Various Types.

214—TYPES OF MOLDS FOR PLASTIC MATERIALS — Flash, Positive, and Positive-Flash Molds.

215 — WAGE PAYMENT PLANS — Piece-Work System that Pleases Everyone—Other Plans.

216—HOW MUCH WILL IT COST? —Cost Recording and Cost Estimating in Machine Shops.

217—OVERHEAD COSTS — How to Determine Burden or Overhead and Know True Costs.

218—SHOP MANAGERS' PROBLEMS —and Solutions which Have Proved Successful.

219—TRADEMARKING PRODUCTS— Stamping, Etching, and Transfer Methods.

220—PERSPECTIVE DRAWING—Simple Diagrams and Examples Illustrate Principles.

221—PATENTS — What Inventors Should Know About Them—Part I.

222—PATENTS — What Inventors Should Know About Them—Part II.

223 — PATENT QUESTIONS — and Their Answers.

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